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A taxonomic review of the genus *Phlebotomus* (Diptera: Psychodidae)

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Synopsis

The 11 subgenera (one new), 96 species (one new) and 17 subspecies of *Phlebotomus* are reviewed and keys are provided for their identification. Accounts are given of fossil sandflies and of the role of *Phlebotomus* in the transmission of disease. Taxonomic citations are provided for each species and subspecies, and an annotated distribution list referring to a map. For some species further notes are given, including references to transmission of disease. It is suggested that 'leg ratio' is worth recording as a measure of leg length in a readily comparable form, and that it provides additional information about certain genera, subgenera, species and infraspecific forms. Evolutionary hypotheses are put forward to explain features of the present distribution of Phlebotominae and leishmaniasis.

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Introduction

General

Phlebotomus Rondani & Berté is one of the two Old World genera of Phlebotominae and includes all the habitual mammal-biters and the vectors of human leishmaniasis in the Old World. Disease of this group have recently increased in several countries and epidemics have followed interruption of malaria control, so that renewed concern about the diseases and new research programmes demand up to date information about the vectors. During the past 80 years intensive study has yielded many widely scattered publications about *Phlebotomus*, particularly from leishmaniasis areas (Anonymous, 1977), and reviews of the genus in three zoogeographical regions have been published. Many species occur in all three of them (Lewis, 1978*b*: 311), and a general survey is required. The present work deals with some basic aspects of *Phlebotomus* throughout the Old World.

The classification of *Phlebotomus* and the Phlebotominae has been discussed by Abonnenc (1972), Fairchild (1955), Lewis *et al.* (1977), Theodor (1948; 1958) and others. I recognize the division of the living Phlebotominae into five genera, *Phlebotomus* and *Sergentomyia* França & Parrot in the Old World and *Warileya* Hertig (Fairchild, 1955: 183; Lewis *et al.*, 1977: 325), *Brumptomyia* França & Parrot and *Lutzomyia* França in the New World. Ready *et al.* (1980) have stressed the undoubted importance of subgenus *Psychodopygus* Mangabeira of *Lutzomyia* and treated it as a genus. Lewis *et al.* (1977: 324) gave reasons against such a course which would involve the elevation to generic rank of several, much more distinctive, Old World subgenera of sandflies and could lead to a general multiplication of genera. Such questions are among the 'pitfalls of perfection' (Nelson, 1978) and are 'handicaps of the human need to compress into linear form the three dimensional world of nature' (Campbell, 1974: 15). Taking a world-wide perspective, I regard *Psychodopygus* as an important subgenus without changing its rank.

Publications (most with keys) dealing with *Phlebotomus* in various areas include the following.

The Old World: Artemiev (1979: 19, *Euphlebotomus*; 1980, *Adlerius*), Lewis (1973), Theodor (1948).

The Palaearctic Region: Artemiev (1978, key with figures for Afghanistan), Croset (1978: 713, key with figures for Tunisia), Lewis & Büttiker, 1981, Saudi Arabia), Nadim & Javadian (1976, Iran), Perfil'ev (1968, key with figures for the U.S.S.R.), Theodor (1958, key and figures for the region).

The Afrotropical Region: Abonnenc (1972, key with figures), Quate (1964, Sudan).

The Oriental Region: Lewis (1978*b*).

The Australian Region: papers by Lewis and Dyce are being completed.

The taxonomic characters are easily seen in flies mounted in gum-chloral medium which may be ringed with Glyceel (Kevan, 1955: 417, 418; Southey, 1970: 51, 53, 56; Tribe, 1972). Potash was hardly ever used for maceration because it weakens intersegmental membranes and makes specimens difficult to remount. It was occasionally used for treating the tip of the abdomen to clarify the spermathecae although it may distort the ducts.

The characters used are described by Abonnenc (1972), Artemiev (1978: 1–8), Forattini (1973), Lewis (1973; 1978*b*: 219), Perfil'ev (1968), Theodor (1958), Young (1979: 5–8) and many others. Lewis's (1973) account is being amplified to include recently introduced characters, some of which are mentioned below.

Head length may be measured from the tip of the clypeus to the most posterior parts of the head, and eye length to include the fore and hind facets. The inter-ocular suture is of some use, but mainly for American species. The inter-arcal area lies between the cibarial chitinous arch and the cibarial teeth. The labrum is measured to include the anterior sensilla. The antennal papillae (Parrot, 1953) were discussed by Wirth & Navai (1978: fig. 5, 47). The dental depth is the distance from the tip of the maxilla to the most proximal tooth.

The relative lengths of various leg segments have been used for classification in several groups of insects, including Lepidoptera (Imms, 1964: 555, 556), aphids (Eastop, 1972: 173), Culicidae (Reid, 1953: 75), Ceratopogonidae (Wirth *et al.*, 1977: 621), Chironomidae (Pinder, 1978: 11, 19; Saether, 1976), Mycetophilidae (Hutson & Kidd, 1975: 29; Hutson *et al.*, 1980: 42), Cecidomyiidae (Panelius, 1965: 5, 132), and Phoridae (Borgmeier, 1964; Schmitz, 1957: 431, couplet 8;

1958). For the Phlebotominae, França (1919: 125) pointed out that leg-segment lengths of each of the species then known varied within narrow limits, and since then many authors have recorded the actual lengths of several or a few segments, mainly in species of *Lutzomyia.* French writers have measured the hind leg of many species. Raynal (1934: 350) indicated the value of the hind tibia-femur ratio for separating two species of *Phlebotomus*, and Zariquiey (1937: 417) used the lengths of basitarsus 1 (longer or shorter than femur 1) and of all tibiae of certain species of *Phlebotomus.* Theodor (1958: 4) remarked that the legs were particularly short in Palaearctic *Sergentomyia*, Artemiev (1978: 4) referred to various measurements of the hind leg, and Young (1979: 7) mentioned tibia length in *Lutzomyia.* L. W. Quate often recorded leg measurements regardless of sex, implying that the sexes are similar in this respect, and other publications indicate that differences are usually small.

In recent years some authors have recorded lengths of leg segments but not always the same ones, some have ceased to make such records, and others have never done so. It is now time to appraise the value of leg characters and of the time spent in measuring them. In the present work, therefore, the lengths of the long segments of each leg, of females when possible, are recorded in a way to allow quick comparison of species. The legs were measured at × 60, with occasional use of × 120 to locate extensions into preceding segments, which were included. Legs detached from the body could usually be recognized as first, second or third because tibia 2 is nearly always longer than 1, and 3 than 2. All lengths are expressed in units of which 100 are the length of femur 1 of a particular species, and the relative lengths of the nine long segments of one side, usually of one fly, are followed by the actual length in mm of femur 1, and of the wing in some cases. Leg diagrams, first drawn on the scale of one unit to one centimetre (examples in Figs 15–24) are useful for comparing species and picking out features of individual species for additional measurements.

The aedeagus comprises two side pieces fused at the base (Perfil'ev, 1968: 32, 42) and protects the tips of the sperm tubes. According to Theodor (1958: 5) these tubes are the true aedeagus, and the 'aedeagus' strictly speaking is the aedeagus sheath. Some authors have recorded the length of the aedeagus but without indicating the basal point from which it was measured. The most convenient point is usually the dorsal hind end near the bases of the coxites, and if other points are used in certain cases they can be indicated.

The last abdominal segment or proctiger of male sandflies is the ninth (Just, 1973: 314, 315, 316, 332) and shows some specific differences. Isaev (1935: 98) noted three types, in *P. papatasi*, in *P. sergenti* and a species of *Sergentomyia*, and in *P. chinensis*, characterized by the length of the surstyles, the nature of their junction to the segment, and the ventral shape of the latter. Appreciable differences are shown by the six species illustrated in Figs 8 to 14. Surstyle is a convenient name for the lateral lobes of the ninth tergite.

Keys to the subgenera and their species are provided and should be used in conjunction with descriptions. Taxonomic citations serve as a guide to literature on the genus, subgenera, species and subspecies. Distribution lists of all species show the sources of information for the maps. References to disease transmission by known or possible vector species show many which are or may be important, and indicate publications on biology as well as disease.

For some species full lists of taxonomic citations would be unduly complex and long, and early references are confined to a few of historic interest.

Where the original or later depository of a holotype, syntypes or other type-material is not shown by a describer, later author or other source, it is deduced (with a query) either from the original paper or another publication which is indicated. Some syntypes have been located with the aid of Abonnenc (1972) although he refers to them as holotypes. Information about the depositories of some types from Afghanistan is given by Artemiev (1978: 23). Types of species described by Professor O. Theodor were kept in the Hadassah Hebrew University Medical School, Jerusalem, until the collection was purchased from the University by the British Museum (Natural History) in 1981.

Distribution data, on which the maps are based, are of three kinds, viz. information about types, publications which give detailed information and often earlier references, and previously unpublished records indicated by collectors' initials or 'BMNH'.

Some Chinese records were not available when this work was being prepared, and are being assembled for publication by Professor Leng Y.-j. They include the description of '*P. major wui*', for which a preliminary note is included below under *P. major*, and records of *P. longiductus* from Xinjiang (Wu *et al.*, 1979).

Fossil Phlebotominae

It is appropriate to consider the fossils of Phlebotominae and their ancestors because they help to explain the relation of *Phlebotomus* to other genera and to the evolution of leishmaniasis. *Leishmania* probably arose from a monoxenic flagellate parasite of the ancestors of sandflies, so there is likely to be a phylogenetic relationship between the leishmaniae and their vectors (Saf'yanova, 1977*b*: 281).

The hopping flight of sandflies doubtless caused many to be trapped in resin, and some excellent fossil specimens have survived in several of the sources of insects in amber (Hennig, 1973: 6). Their approximate ages in MYA (millions of years ago) quoted below were supplied by Dr P. E. S. Whalley or taken from the British Museum (Natural History) (1972) time scale, Riek (1970) or the work of Smith & Briden (1977) which was also consulted for continental movements. Wings of the following species are illustrated (Figs 20–33) to give an impression of the groups mentioned here and later: *Permotipula patricia* Tillyard, 1929: 779 (Rohdendorf, 1974: 6), *Phlebotomites brevifilis* Hennig, 1972: 40, 62, *Phlebotomus tipuliformis* Meunier (Fig. 27 after Hennig), *Warileya nigrosacculus* Fairchild & Hertig, *P.* (*Spelaeophlebotomus*) *minteri*, *P.* (*Idiophlebotomus*) *frondifer*, *Lutzomyia paterna* (Quate, 1963), *Brumptomyia galindoi* (Fairchild & Hertig), *P.* (*Paraphlebotomus*) *sergenti*, *Lu.* (*Dampfomyia*) *permira* (Fairchild & Hertig), *Sergentomyia* (*Neophlebotomus*) *gombaki* (Lewis & Wharton), *S.* (*Sergentomyia*) *bedfordi* (Newstead), *S.* (*Sergentomyia*) *fallax* (Parrot) and *S.* (*Parvidens*) *lesleyae* (Lewis & Kirk).

370 MYA, Devonian

The earliest known insect, a wingless form, was living about this time (Riek, 1970: 168).

230 MYA, Upper Permian

The mecopteran *Permotipula* exemplifies a primitive wing to which that of *Nemopalpus* Macquart, though unrelated (Rohdendorf, 1974: 6), is remarkably similar. *Nemopalpus* is probably among the most primitive living Diptera, close to the basic stock of the Psychodidae and to the Phlebotominae in the matter of venation (Fairchild, 1955: 182; Lewis *et al.*, 1977: 323).

The original Diptera, present at this period, were probably biting flies feeding on insects or vertebrates and contemporaneous with the beginning of the reptile age, when the theromorph ancestors of mammals existed before the origin of birds (Downes, 1971: 241, 261, 262).

220 MYA, Lower Triassic

The infraorder Dictyodipteromorpha of the dipterous suborder Archidiptera was probably in existence; it flourished in the Upper Triassic and was apparently the ancestral group which gave rise to two branches, the infraorder Tipulimorpha Rohdendorf and all other later Diptera (Rohdendorf, 1974: 27, 55, 129, 136, 289, 329).

160 MYA, Middle Jurassic

The Tipulimorpha were established (Rohdendorf, 1974: 3, 291, 292) and included the tipulid family Tanydophryneidae Rohdendorf which appears to have been ancestral to 'superfamily' Psychodidea [fossil Psychodidae] (Rohdendorf, 1974: 3, 53, 219, 228, 291–293). This ancient group, distinguished from all other Tipulimorpha by primitive larval features, has retained a complex wing venation but its members have become smaller and thus been able to colonize microhabitats (Rohdendorf, 1974: 53, 58, 292). Before the end of the Jurassic the ancient group of the Phlebotominae, among the smallest of Diptera, must have come into existence (Hennig, 1972: 38, 55, 58), in which the origin of R_{2+3} has been displaced towards the wing tip so that the vein seems to come from R_4, and R_2 has been reduced (Hennig, 1969: 385). R_{2+3} is usually branched only in the most primitive Diptera (Colless & McAlpine, 1970: 664). Hennig's important 1972 paper was probably based largely on previous work unpublished owing to the second world war (Schlee, 1978: 382).

120 MYA, Lower Cretaceous

The first known two species of Phlebotominae existed in what is now the Lebanon and was south of the Tethys Sea (Hennig, 1972: 38; Melville, 1967: 293). The small, evidently primitive *Phlebotomites longifilis* Hennig, 1972: 40, 62, and *Phlebotomites brevifilis* Hennig, 1972: 40, 62 (Stuckenberg, 1975: 459), had wings with a broad distal half and broadly rounded tip which may have accounted for a displacement of the origin of R_{2+3} beyond that of R_5 (Hennig, 1972: 8, 27, 39, 43, 51). Although these species show few very striking differences from some recent forms they were included in a new genus because close relationship to *Phlebotomus* was not indicated. Hennig (1972: 21, 28) considered that they might belong to the ancestral group of the Phlebotominae or to his probably monophyletic 'Phlebotominae *s. str.*' which comprises *Phlebotomus*, *Sergentomyia*, *Brumptomyia* and *Lutzomyia*. Stuckenberg drew attention to the short palpal segment 5 of *Phlebotomites brevifilis* which is like that of some American sandflies. The two Cretaceous species and the present-day Neotropical *Warileya* have a similar type of wing structure and may be the sole remnants of an early movement from Africa to South America or vice versa across a south Atlantic connection in the Lower Cretaceous or earlier (Hennig, 1972: 38, 39, 44).

30 MYA, probably Upper Eocene

One poorly described species is known from Baltic amber (Rohdendorf, 1974: 275), *P.* (*Phlebotomiella*) *tipuliformis* Meunier, 1905*b* [as *P. tipuliformis*]; 1906: 103 [as *Phlebotomiella tipuliformis*]; 1912: 71 [as *P.* (*Phlebotomiella*) *tipuliformis*] (Fairchild, 1955: 183–187; Hennig, 1972: 51–55; Stuckenberg, 1975) and may have lived in the amber forest and fed on thin-skinned reptiles (Larsson, 1978: 92, 93). Hennig regarded it as a member of his Phlebotominae *s. str.* and perhaps of genus *Phlebotomus* and of subgenus *Euphlebotomus* or *Anaphlebotomus*, which showed that splitting of the ancient Phlebotominae was already far advanced. Stuckenberg referred to the short palpal segment 5 and primitive wing of *P. tipuliformis* and considered it to be congeneric with *Phlebotomites* and somewhat intermediate between it and 'Phlebotominae *s. str.*'.

26 MYA, Miocene

Lu. paterna (Quate, 1963: 114) (Hennig, 1972: 56, 59, 62, fig. 41) is the first known phlebotomine with a narrow wing and is related to living reptile-feeding species.

One MYA to the present day

Philaematus pungens Loew, 1845: 8 (Parrot, 1951: 28; Duckhouse & Lewis, 1980: 99) from copal of unknown origin, '*Phlebotomus pungens*' Meunier, 1905*a*: 209 (Duckhouse & Lewis, 1980: 99) from Zanzibar copal, and *S. succini* (Stuckenberg, 1975: 456) (Lewis *et al.*, 1977: 326; Duckhouse & Lewis, 1980: 105) from copal, possibly East African, may be less than one MYA and represent living species of *Sergentomyia*. Several specimens from African copal examined proved to belong to this genus, and one, treated with xylol and mounted in Euparal, clearly shows pharyngeal teeth, antennal ascoids and palpal sensilla.

Distribution

Quate (1962: 169, 170) regarded the Phlebotominae as tropical with northern intrusions. Sandflies occupy most of the Old World other than cold regions and oceanic islands, and they are absent from the Seychelles (Scott, 1933: 369), and *Phlebotomus* from Madagascar (Brygoo, 1974). Sandflies are considered to need at least 50 days a year with a temperature not less than 20°C (Perfil'ev, 1968: 98). Map 1, showing the general distribution of the subfamily in the Old World, is based on data cited by Lewis (1974) and Léger & Rodhain (1978). In western Europe *P. perniciosus* and *P. mascittii* occur about as far north as 49°N, and in Asia *P. chinensis* is the most northerly species (Perfil'ev, 1968: 89), reaching about 48°N (Beklemishev & Dolmatova, 1948: 354). In Canada sandflies are known from about 50°39′N near Kamloops, from 49°39′N at Coulee Creek in Alberta, and at 44°41′N near Ottawa. The southern boundary of sandflies in the Old and New Worlds is about 40°S (Perfil'ev, 1968: 90). The maps illustrate a mainly northern distribution of *Phlebotomus*, which is discussed later. It is exemplified by the northern distribution of *Larroussius*, and therefore of kala-azar, in Tunisia (Croset *et al.*, 1978: 744), and by the presence of five *Phlebotomus* species out of six Phlebotominae in France, and two out of 26 in Zaire (Vattier & Bimangou, 1974: 92; Vattier & Trouillet, 1975: 2; 1978: 701). Some 35 species, including *P. orientalis*, have marked eastern or western limits.

Biology

Numerous publications dealing with this extensive subject may be located by reference to Abonnenc (1972), Lewis (1973; 1974*a*; 1977; 1978*a*; 1978*b*), Perfil'ev (1968) and others, and notes on various species in the present work. The following brief note refers to a few aspects.

Sandfly larvae are difficult to find and many live in soil or burrows of animals. Development from egg to adult takes weeks or months according to temperature, and larvae undergo diapause in some northern and other areas. Many adults of both sexes feed on sugar and the females take vertebrate blood. Adults are active at night and rest in various shelters by day. Movement varies from short hops to flights of a few hundred metres and occasionally nearly 2 km, and is usually stopped by moderate wind. Palaearctic species tend to have one or two generations a year, and some tropical ones flourish in either the dry or the wet season.

The genus *Phlebotomus* includes all the habitual mammal-biters and therefore all the sandfly vectors of human disease in the Old World.

Relation to disease

The following summary of relation to disease in the Old World is supplemented by notes on some species. The leishmaniases are the main group of sandfly-borne vertebrate infections. It seems probable that *Leishmania* Ross, 1903; Wenyon, 1926: 396, having arisen as an insect parasite, came to infect reptiles and eventually mammals (Lewis, 1978*a*: 94; Telford, 1979: 322; Wilson & Southgate, 1979: 243), so that sandflies may be regarded as the primary hosts (Lainson & Shaw, 1979: 2). This phylogenetic priority is not only of historical interest for it is reflected in present-day associations which have a practical significance. Lizard leishmanias now occurs in the Old World and possibly in the New World (Lainson & Shaw, 1979: 34). No *Leishmania* is known in birds (Adler, 1964: 42).

Many forms of *Leishmania* are transmitted among mammals by species of *Phlebotomus*. Basically, each causes a zoonosis into which man may enter to a varying extent, so that human involvement ranges from sporadic cases to a purely man-sandfly infection. Probably in Asia leishmaniae caused enzootics in canids and rodents which led to certain anthroponotic forms which spread to some other Palaearctic areas (Garnham, 1971: 482, 488; 1977: 18; Hoogstraal & Heyneman, 1969: 1185; Lysenko, 1971: 515–518).

The forms of *Leishmania* are now being classified by means of objective biochemical, serological and other studies of their intrinsic characters (Chance, 1979; Chance *et al.*, 1977; Garnham, 1976: 536; Lumsden, 1977: 47; de Raadt, 1977: 314; Taqi & Evans, 1978: 56; Williams & Coelho, 1978; Zuckerman & Lainson, 1977: 89), and many forms will probably be recognized.

For a long time the leishmaniae were grouped, according to their normal (Lainson & Shaw, 1971: 21) effect on the (secondary) human host, into visceral leishmaniasis (VL) or kala-azar and cutaneous or dermal leishmaniasis (CL) which causes oriental sore and other diseases. This grouping is unsatisfactory (Chance *et al.*, 1977: 53, 56) but, despite rapidly changing concepts, is still of some practical value. It is used here, where the taxonomic names of the parasites are taken mainly from Lumsden (1977*a*: 46, 49; 1977*b*).

VL is caused by forms of the *Le. donovani* (Laveran & Mesnil, 1903*a*; 1903*b*: 958) complex which occur largely in wild Canidae and are transmitted mainly by species of the subgenera *Larroussius* and *Adlerius*. The anthroponotic leishmaniasis of eastern India is due to *Le. d. donovani* which has no dog or other animal reservoir and is transmitted by a species of *Euphlebotomus*. *Le. d. infantum* Nicole, 1908, probably spread from Asia via Transcaucasia into the Mediterranean area where it attacks dogs and children rather than adults. VL probably spread eastwards via the Gobi Desert to eastern China (Beklemishev & Dolmatova, 1948: 351). The east African VL is transmitted by a species of *Synphlebotomus*, and may infect animals as secondary hosts (Lysenko, 1971: 518).

CL is due largely to members of the *Le. tropica* (Wright, 1903) group. The wild hosts, if any, are usually rodents, and most of the sandfly vectors belong to the subgenera *Phlebotomus* and

Paraphlebotomus. Le. t. major Yakimov: 1915: 501; Zuckerman & Lainson, 1977: 67 occurs largely in central Asia (Lysenko, 1971: 518; Lysenko & Belaev, 1977: 250, map) where it infects *Rhombomys opimus* Lichtenstein, 1823, and some other rodents, and causes 'moist sore' in man. *Le. t. tropica* (= *minor* Yakimov) was possibly derived (Hoogstraal & Heyneman, 1969: 1184) from *Le. t. major*, occurs from the Mediterranean area to India (Lysenko, 1971: 58), is largely urban, causes 'dry sore' in man and infects dogs. *Le. aethiopica* Bray, Ashford & Bray is a hyrax parasite which causes disseminated CL in Ethiopia and is transmitted by a species of *Larroussius*.

VL and CL usually occur in different areas (Lysenko, 1971: 518, 519; Lysenko & Beliaev, 1977: 250; Theodor, 1964: 487), largely owing to the distribution of their vectors.

The recognition of a vector is a complex process involving many subjects which include sandfly taxonomy, distribution, host choice and other aspects of ecology, determination of flagellates found in wild flies, development of leishmaniae ingested by flies in the laboratory, and experimental transmission. Proof that a species is a vector can seldom be obtained, and it applies only to a particular place and time; de Raadt (1977: 314) pointed out that detailed study of epidemiology only gives an instantaneous reflection of a process continuing over a long period. The significance of a vector may alter (Lysenko & Beliaev, 1977*b*: 263; Sergiev, 1977: 283). There are many gradations from occasional to habitual minor and major vectors. It is therefore impossible to draw up a simple list of vectors, but a list of vectors and suspected vectors is of some value, especially if followed by a summary of the evidence related to each species. In the present work this is confined to references to the literature.

Killick-Kendrick (1978: 299, 300) listed 52 taxa, 28 of them Old World form, of *Phlebotomus*, known or suspected of being vectors of leishmaniasis. The Old World taxa, listed in relation to types of the disease in man are: visceral (*Synphlebotomus*) *celiae*, *martini*, *vansomerenae*, (*Larroussius*) *ariasi*, *kandelakii kandelakii*, *longicuspis*, *major* s. l., *orientalis*, *perniciosus perniciosus*, *tobbi*, (*Adlerius*) *chinensis chinensis*, *ch. halepensis*, *longiductus*, *simici*, (*Euphlebotomus*) *argentipes*; cutaneous (with four marked '+ VL?' which may transmit kala-azar locally): *P.* (*Phlebotomus*) *bergeroti*, *duboscqi*, *papatasi* (+ VL?), *salehi*, (*Paraphlebotomus*) *alexandri*, *caucasicus* (+ VL?), *chabaudi*, *mongolensis* (+ VL?), *sergenti sergenti*, (*Synphlebotomus*) *ansarii*, (*Larroussius*) *longipes*, *pedifer*, *perfiliewi* (+ VL?). *P. rossi* is a recent suspect.

In addition to known vectors some sandflies presumably transmit VL among animals in large areas of Africa where the human disease occurs but is rare (Gigade, 1978: 239), and in part of the Sudan (Hoogstraal & Heyneman, 1969: 1141) and elsewhere where the infection is present with no apparent vector.

Many apsects of vectors have been discussed by Adler (1964: 48, 80), Bray (1974: 91), Hoogstraal & Heyneman (1969), Killick-Kendrick (1978; 1979), Lewis (1971; 1974; 1978*a*), Minter (1972), Molyneux (1977: 43–53), Saf'yanova (1967), Sergiev (1967: 26; 1979) and Williams & Coelho (1978).

Sandfly fever virus, transmitted by *P. papatasi* and possibly other species (Perfil'ev, 1968: 128), occurs mainly in the Mediterranean area.

Most vector species are difficult, and some impossible, to control. Domestic species were largely controlled by house-spraying against malaria vectors but have increased where this has been stopped, in India, for instance, and in Greece where VL and CL increased when mosquito-spraying ceased (Léger *et al.*, 1979: 12). Sandflies have shown little resistance to insecticides (Killick-Kendrick, 1978: 304) till recent instances in India.

Explanation of terms

Various

Antenna 3 etc.	Antennal segment 3 etc.
Chahar Mahal	Part of Bakhtiar va Chahar Mahal Province, Iran
Chinese, romanization of spelling	The Pinyin system, adopted in the 1980 edition of *The Times Atlas*, is used here
CL	Cutaneous leishmaniasis
Gamma	The distance between the origin of wing-veins R_{2+3} and R_4 and the origin of R_5

Gruziya	Georgian S.S.S.R. (Georgia)
ICZN	*International Code of Zoological Nomenclature* (1964) and Amendments (1973)
Inverted commas	Places in distribution lists not located
Kosovo i Metohija	Present name for Kosmet, Yugoslavia
Le.	*Leishmania*
Leg segments	100 units = length of femur 1
Lu.	*Lutzomyia*
Map symbol underlined	Locality approximate
MYA	Millions of years ago
P.	*Phlebotomus*
Palp 3 etc.	Palp segment 3 etc.
R_2 etc.	Radius branch 2 and other wing veins
S.	*Sergentomyia*
Sperm pump and tubes	Genital pump and filaments
Transcaucasia	Historic name for U.S.S.R. area south of Caucasus (now Armenia, Azerbaydzhan and Gruziya)
VL	Visceral leishmaniasis
WL	Wing length in mm

Names of collectors mentioned

A. E. E.	A. E. Eaton
C. A. V. B.	C. A. V. Barkhuus
D. J. L.	D. J. Lewis
D. M. A.	D. M. Ackland
D. M. M.	D. M. Minter
E. K. S.	E. K. Saliba
E. M.	Unknown
G. B. W.	G. B. White
G. S.	G. Shidrawi
H. C. B.	H. C. Barnett
H. W. L.	H. W. Leathem
J. A. S.	J. A. Sinton
J. O. C.	J. Omer-Cooper
J. P. M.	J. P. McMahon
J. P. T. B.	J. P. T. Boorman
J. P. D.	J.-P. Dedet
J. W.	J. Waterston
J. Wn.	Jane Wilson
K. B.	K. Behbehani
K. K.	K. Kertész
K. Z. D.	K. Zein el Dine
L. E. S.	L. E. Stephen
L. Y.-j.	Leng Yan-jia
M. A.	M. Ashraf
M. A. R.	M. A. Rifa'at
N. L. C.	N. L. Corkill
P. A. B.	P. A. Buxton
P.	Petrie
R. A. B.	R. A. Bolt
R. E. D. B.	R. E. Drake Brockman
R. L. C.	R. L. Coe
R. P. L.	R. P. Lane
R. W. A.	R. W. Ashford
S. A.	S. Adler
S. A. S.	S. A. Smith
S. J. R.	S. J. Rahman
S. T.	S. Taussig
V. D.	V. Dhanda
Y. S.	Y. Schlein

Depositories, actual, probable or original

ANIC, Canberra	Australian National Insect Collection, Commonwealth Scientific and Industrial Research Organisation, Canberra.
BMNH	British Museum (Natural History)
BPBM, Honolulu	Bernice P. Bishop Museum, Honolulu
CA, Los Baños	College of Agriculture, Los Baños, Philippines
CFHS, Nanking	Central Field Health Station, Nanking
CIH, Sydney	Commonwealth Institute of Health, Sydney, Australia (till 1980 School of Public Health and Tropical Medicine)
CRI, Kasauli	Central Research Institute, Kasauli
EM, Montpellier	Laboratoire d'Ecologie, Université de Montpellier, France
FM, Paris	Laboratoire de Parasitologie, Faculté de Médicine, Paris
IH, Scoplje	Institute of Hygiene, Skoplje, Yugoslavia
IP, Algiers	Institut Pasteur, Algiers
IP, Paris	Institut Pasteur, Paris
IPH, Tehran	School of Public Health and Institute of Public Health, Tehran
L, Bastia	Lycée, Bastia, Corsica
LSHTM, London	London School of Hygiene and Tropical Medicine, London
NM, Vienna	Naturhistorisches Museum, Vienna
MB, Corales	Musée Bocage, Colares, Portugal
MC, Kweiyang	Medical College, Kweiyang, China
MH, Sinferopol	Military Hospital, Sinferopol, U.S.S.R.
MI, Moscow	Institute of Tropical Medicine and Parasitology, Moscow [Location of some holotypes mentioned by Artemiev, 1978: 23.]
MRAC, Tervuren	Musée Royal de l'Afrique Centrale, Tervuren, Belgium
NM, Nairobi	National Museum of Kenya, Nairobi
PIPD, Shantung	Provincial Institute of Parasitic Diseases, Shandong
SAIMR, Johannesburg	South African Institute of Medical Research, Johannesburg, South Africa
TI, Dushanbe	Tropical Institute of Tadzhiskaya S.S.S.R., Dushanbe
TI, Tbilisi	Tropical Institute, Tbilisi
TM	T. Maa's collection
U, Moscow	University, Moscow
U, Pavia	University of Pavia, Italy
U, Vienna	University, Vienna
US, Tashkent	Protozoology Division, Uzbekistan Sanitary and Biological Institute, Tashkent
ZSI, Calcutta	Zoological Survey of India, Calcutta
ZI, Leningrad	Zoological Institute, Academy of Sciences of the U.S.S.R., Leningrad

Keys, citations, distribution and notes

Genus *PHLEBOTOMUS* Rondani & Berté

Flebotomus Rondani & Berté in Rondani, 1840: 12. Type-species: *Bibio papatasi* Scopoli, by monotypy.
Phlebotomus Rondani & Berté; Loew, 1845: 9 [emendation; first use of this name and Phlebotomidae mentioned by Lewis *in* Lewis *et al.*, 1977: 321 incorrect; spelling fixed under suspension of rules by ICZN, 1954, Opinion 256: 199]; Summers, 1911; Theodor, 1948: 96; 1958: 316; 1965: 179; Fairchild, 1955: 188; Quate, 1964: 237, 238; Lewis, 1967: 14; 1973: 162; 1978*b*: 233; Perfil'ev, 1968: 218; Abonnenc, 1972: 75, 92; Lewis, Young, Fairchild & Minter, 1977: 321, 326; Abonnenc & Léger, 1977: 71, 76; Duckhouse & Lewis, 1980: 99.

Cibarium of female usually without a row of teeth but often having a group of spicules, pigment patch usually absent. Antenna 3 usually long, three or more segments of male with two ascoids. Mesanepisternum usually with a few antero-ventrad hairs (Abonnenc & Léger, 1977: 71, 72). Abdominal tergites 2–6 with many erect hairs. Spermathecae usually segmented. Style with three to five spines, only one or two terminal. Paramere often complex. Species often large and pale.

There are a few omissions from the keys because only the female is described for *P. sejunctus*, *teshi*, *tubifer* (male found), *pexopharynx*, *betisi* and *somaliensis*, and only the male for *P. buccina-*

tor, *papuensis*, *trifilis*, *katangensis*, *fantalensis*, *chadlii*, *langeroni*, *mariae*, *perfiliewi galilaeus*, *comatus* (female found) and *caudatus*, and because species A, B, C and D are not yet described, the females of *P. brevis brevis*, *P. chinensis halepensis* and *P. ch. kyreniae* and the male of the latter are not sufficiently described, and the descriptions of '*P. major wui*' and *P.* (*Eu.*) *autumnalis* Artemiev were not available in time. Suitable descriptions of the missing forms could lead to improved keys.

Key to the subgenera of *Phlebotomus*

1 Distance between bases of R_4 and R_5 relatively short, not more than a quarter of width of wing. A pair of rods present next to genital pump. Palpal sensilla not spatulate.
Antenna 3 very long and much longer than palp. Palp short, with segment 5 shorter than or equal to 3. Style very long. Spermathecal ducts usually short and wide 2

– Distance between bases of R_4 and R_5 relatively long, at least a third of width of wing. Genital pump without adjacent rods. Palpal sensilla spatulate 3

2 Vein M_{1+2} forking at level of radio-median cross-vein, before base of R_4. Cibarium of female unarmed. Antenna 3 = 2·3 to 2·5 times length of labrum. Palp segment 3 not enlarged at base, with sensilla scattered on flat surface. Style with four spines and a long hair. Afrotropical Region. . . . . Subgenus ***SPELAEOPHLEBOTOMUS*** (p. 131)

– Vein M_{1+2} forking beyond level of radio-median cross-vein, beyond base of R_4. Cibarium of female with teeth covering a large area. Antenna 3 about three or more times length of labrum. Palp segment 3 enlarged at base, with sunken patch of sensilla. Style with three to five thick spines and sometimes several thick hairs. Oriental, Palaearctic and Australian Regions Subgenus ***IDIOPHLEBOTOMUS*** (p. 133)

3 Style with three spines.
Female with row of about five to ten cibarial teeth, few or no hypopharyngeal teeth, and thin-walled spermathecae. Male with genital filaments short or very short, paramere simple and beak-like, and coxite with simple hair pattern Subgenus ***AUSTRALOPHLEBOTOMUS*** (p. 135)

– Style with four or more spines 4

4 Coxite with hairy process near base. Genital filaments short, 1·3 to 2·3 times length of pump . 5

– Coxite without such process. Genital filaments 3 to 11 times length of pump 7

5 Coxite 0·37 to 0·74 mm long, its process very small. Style long and cylindrical with three distal spatulate spines and two other spines. Paramere with two upward processes. Surstyle with distal spines. Pharyngeal armature of female comprising either a network of lines or scales. Spermatheca with nearly equal segments and a refractive membrane near the distal one Subgenus ***PHLEBOTOMUS*** (p. 137)

– Coxite 0·20 to 0·33 mm long, its process usually large, and having a brush of long hairs. Style not long, with four or five spines. Paramere simple, distal upper surface flat and elliptical with short hairs. Surstyle without distal spines. Pharynx of female with teeth or scales. Spermatheca sometimes with differentiated rounded end-segment 6

6 Style with four long spines, two near the tip and two near the base. Pharynx of female with large backwardly directed teeth . . . . . . Subgenus ***PARAPHLEBOTOMUS*** (p. 142)

– Style with five long spines, two at the tip and three near the middle. Pharynx of female with irregular scales or punctiform teeth . . . . Subgenus ***SYNPHLEBOTOMUS*** (p. 148)

7 Style with four long spines, one distal, one subterminal, and two near middle.
Paramere with one or two extra lobes, with or without accessory spine. Aedeagus sometimes conical. Pharynx of female with a small group of teeth in middle, and behind it some concentric lines. Spermatheca segmented, end-segment not enlarged Subgenus ***ANAPHLEBOTOMUS*** (p. 170)

– Style with five long spines 8

8 Paramere with one or two extra lobes, with or without accessory spine. Pharynx of female as in *Anaphlebotomus*.
Spermatheca with differentiated end-segment . . Subgenus ***EUPHLEBOTOMUS*** (p. 168)

– Paramere without extra lobes. Pharyngeal armature otherwise 9

9 Paramere truncated.
Antenna 3 and legs long, and wings narrow. Spermatheca moniliform. Haltere of male with broad stalk. Paramere with adjacent rod . . . . . Subgenus ***KASAULIUS*** (p. 172)

– Paramere not truncated 10

10 Pharynx of female and male with punctiform teeth (large in *wenyoni*), except in *mascittii* which has large irregular teeth. Spermatheca segmented, with long finger-like neck except in *somaliensis*, which has a rather long end-segment, and *mascittii*, which has a spermatheca with transverse striations often in distal part, a small head, little or no narrowing, and a wide duct. Genital filaments three to five times as long as pump . . Subgenus ***LARROUSSIUS*** (p. 150)

– Pharynx of female with triangular or rounded group of medium-size teeth. Spermatheca incompletely segmented. Genital filaments usually very long, 6·6 to 11·0 length of pump Subgenus ***ADLERIUS*** (p. 163)

Tibia 3 in certain species

The following records of relative lengths of tibia 3 (femur 1 = 100 units, females unless males indicated) are placed here for species about which no other taxonomic information is given.

P. aculeatus (Kenya) ♂, 182 (2·26 mm); *betisi*, 199; *gibiensis* ♂, 212 (2·30 mm); *guggisbergi*, 188; *kandelakii kandelakii*, 164; *longicuspis* (Algeria) ♂, 181; *major major* (Nepal), 193; *orientalis* (Yemen), 173; *pedifer* (Kenya), 177; *perfiliewi perfiliewi* (Italy), 177; *smirnovi* (U.S.S.R.) ♂, 147; *tobbi* (Greece), 179; *angustus* ♂, 189; *hindustanicus* (Pakistan) ♂, 202; *rupester* ♂, 163; *simici* (Yugoslavia) ♂, 164; *kiangsuensis* ♂, 185; *colabaensis*, 185; *rodhaini* (Sudan), 167; sp. D ♂, 189 (2·66 mm); *stantoni*, 176.

Subgenus ***SPELAEOPHLEBOTOMUS*** Theodor

Phlebotomus subgenus *Spelaeophlebotomus* Theodor, 1948: (94), 100, 108; Quate & Fairchild, 1961: 208; Lewis, 1973: 162; Lewis, Young, Fairchild & Minter, 1977: 325, 326. Type-species: *Phlebotomus gigas* Parrot & Schwetz, 1937, by original designation.

Spelaeophlebotomus Theodor; Abonnenc & Minter, 1965: 30; Vattier-Bernard, 1970: 189; Forattini, 1971: 97; Abonnenc, 1972: 88; Abonnenc & Léger, 1976: 76.

Theodor provisionally treated this taxon as a subgenus and Abonnenc & Minter raised it to generic rank on the strength of wing venation. After discussion with Professor Theodor (1972; 1974, in *litt.*). I consider that wing features of this group, and possibly the American *Warileya*, do not justify generic treatment. For this reason, and in the interests of stability (Lewis *et al.*, 1977), *Spelaeophlebotomus* is here treated as a subgenus.

Key to the species of subgenus *Spelaeophlebotomus*

1 Antenna 3 of female 2·3–2·5 length of labrum. Paramere of male with slight basal swelling ***gigas*** (p. 131)

– Antenna 3 of female 3·9 length of labrum. Paramere of male with long setiferous lobe . ***minteri*** (p. 131)

Phlebotomus (*Spelaeophlebotomus*) *gigas* Parrot & Schwetz

(Map 1)

Phlebotomus gigas Parrot & Schwetz, 1937: 224 [♀]; Parrot & Wanson, 1938: 153 [♂]; 1946: 143; Kirk & Lewis, 1946*b*: 119; 1948: 327; 1951: 438; Parrot, 1953: 114. Syntypes 4 ♀, Zaire (MRAC, Tervuren).

Phlebotomus (*Spelaeophlebotomus*) *gigas* Parrot & Schwetz; Theodor, 1948: 94, 108.

Spelaeophlebotomus gigas Parrot & Schwetz; Vattier-Bernard, 1970: 194; Abonnenc, 1972: 89.

Distribution. **Africa**: Abonnenc (1972: 261, map); Vattier-Bernard (1970: 194, 221, early stages, map).

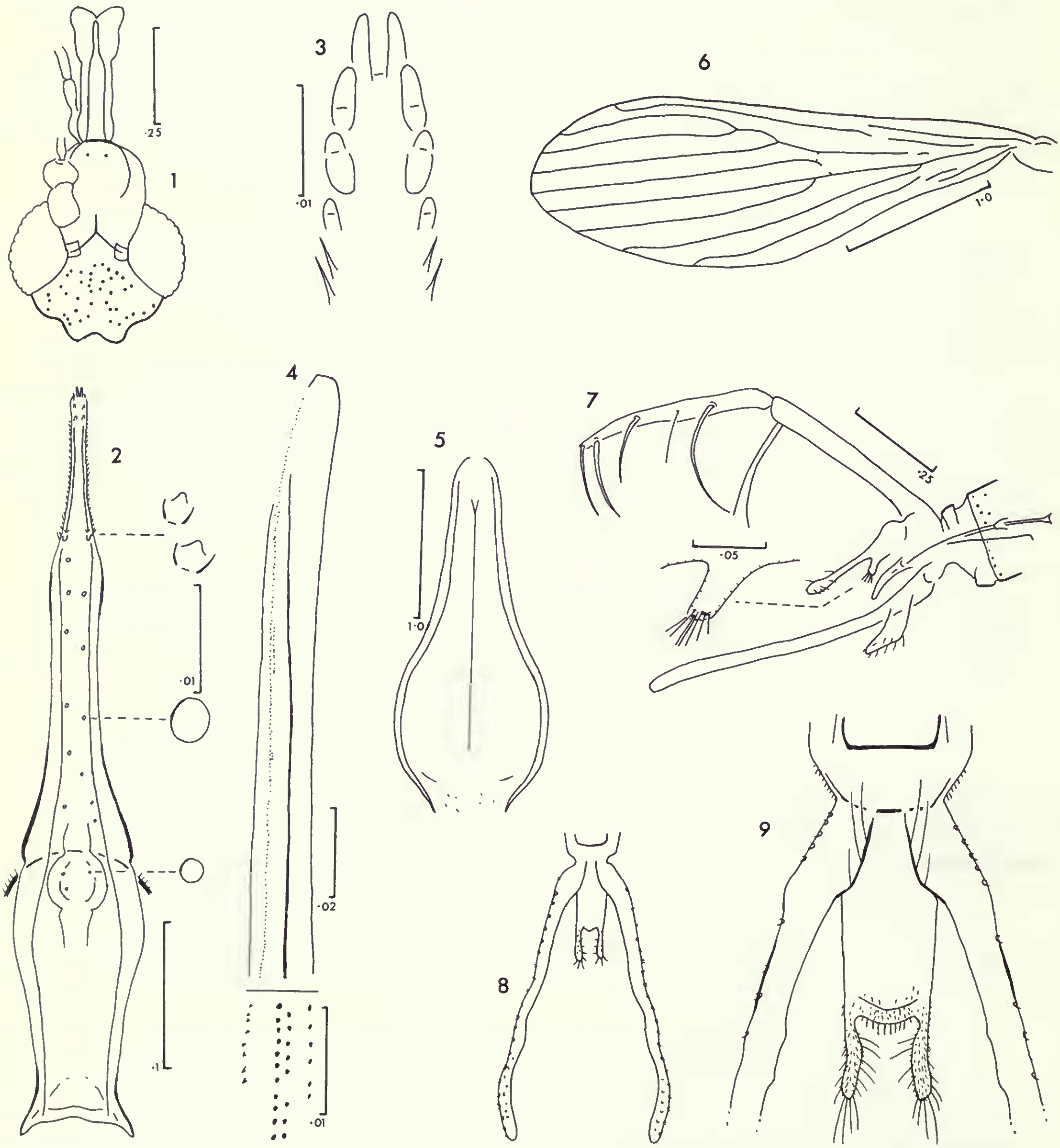
Note. *P. gigas* is a very large species which lives in caves and bites bats and other small animals and will attack man (Abonnenc, 1972: 90).

Phlebotomus (*Spelaeophlebotomus*) *minteri* sp. n.

(Figs 1–9, Map 1)

♀. Head 0·52 mm long, eye 0·45 of its length with more than 50 facets, interocular suture complete, clypeus with few hairs. Labrum 0·31 mm long, 0·61 length of head, 0·09 length of wing, with narrow apical part, subapical sensilla very close together, and few cibarial sensilla. Cibarium with no chitinous arch, teeth or pigment patch. Pharynx with marked subterminal bulge and scarcely visible spicules. Hypopharynx with about 50 teeth on each side. Antenna 3 = 1·22 mm long, 1·17 length of 4 + 5, 3·88 length of labrum, 0·35 length of wing, ascoids not clear but probably as in *P. gigas*, papillae not seen. Mandible pointed, with minute teeth. Maxilla with no lateral teeth, 50 or more ventrals, some of them in two rows, and a dental depth of 0·17 mm; palpal formula 10, 20, 42, 20, 41; eight mesad sensilla on segment 3. Scutum and pleuron pale, prosternal lobes short, mesanepisternum without hairs. Leg formula 100, 184, 201; 86, 195, 181; 97, 211, 198 (3·50, 1·59). Wing length 3·50 mm, 3·18 width, R_2/R_{2+3} 4·33, R_1 overlap/R_2 0·66, R_1 and R_2 markedly curved, venation as in *P. gigas*. Haltere long. Abdominal tergal hairs erect and rather evenly spread. Spermathecae invisible in specimen.

♂. Eye 0·45 length of head. Interocular suture complete. Labrum 0·20 (0·19–0·21) mm long, 0·07 (0·07–0·07) length of wing. Cibarium and pharynx virtually unarmed. Antenna 3 = 1·23 (1·17–1·29) mm long, 1·12



Figs 1–9 *Phlebotomus minteri*. (1) ♀, head; (2) ♀, labro-cibarium; (3) ♀, tip of labrum; (4) ♀, maxilla, with fore, middle and hind ventral teeth enlarged; (5) ♀, pharynx; (6) ♀, wing; (7) ♂, terminalia; (8, 9) ♂, abdominal segment 9.

(1·10–1·15) length of 4 + 5, 6·18 (6·09–6·25) length of labrum, 0·43 (0·43–0·44) length of wing. Ascoids unclear in balsam mounts. Wing length 2·85 (2·66–2·95) mm long, 3·45 times width, $R_2/_{2+3}$ 5·42 (4·35–6·10), R_1 overlap/R_2 0·71 (0·66–0·86). Aedeagus curving downward, with blunt end; filament 2·4 length of pump, with nearby pair of rods. Paramere with sub-basal hairy lobe, widening near tip. Coxite with two long ventral hairs near tip; style narrow with four spines and one seta. Segment 9 as figured.

MATERIAL EXAMINED

Holotype ♂, **Tanzania**: Amboni Cave, 5°04′S 39°02′E, 26.x.1957 (*D.M.M.*) (BMNH).
Paratypes. 1 ♀, 4 ♂, same data (all in BMNH except one ♂ in LSHTM, London).

COMMENTS. This species is named after Dr D. M. Minter in appreciation of his important work on sandflies and leishmaniasis. *P. minteri* differs from *P. gigas* chiefly in having a relatively longer labrum in both sexes and a pronounced parameral lobe in the male. The eyes are not very small. The maxillary dentition is remarkable, presumably suited to bat-feeding, and the partly double row of teeth may be unique to this subgenus.

The Amboni Cave has been described by Cooke (1970) and Peet (1957: 152). Dr Minter caught the sandflies on the wall of the cave, and informs me that about the same year four species of bats, *Tritaenops persicus afer* Peters, 1877, *Coleura afra* (Peters, 1852), *Tadarida* (*Chaerepha*) *pumila* (Cretzschmar, 1826) and *Miniopterus minor* (Peters, 1867) were caught in the caves by Mr Colley and identified by Dr D. L. Harrison.

Subgenus *IDIOPHLEBOTOMUS* Quate & Fairchild

Phlebotomus subgenus *Idiophlebotomus* Quate & Fairchild, 1961: 208; Theodor, 1965: 176; Lewis, 1973: 162; 1978: 250; Lewis & Lane, 1976: 53; Abonnenc & Léger, 1976: 76. Type-species: *Phlebotomus asperulus* Quate & Fairchild, 1961, by original designation.

The status of this subgenus is discussed with that of *Spelaeophlebotomus*. Most species live in caves and probably feed on bats.

Key to the species of subgenus *Idiophlebotomus*

Females

1	Cibarial armature with median rod or big tooth	2
–	Cibarial armature without median rod or big tooth	7
2	Cibarial median rod with large serrations	***asperulus*** (p. 134)
–	Cibarial median rod with minute serrations or none	3
3	Cibarium without patch of teeth except a few granulose spicules	***erebicolus*** (p. 134)
–	Cibarium with patch of teeth	4
4	Median cibarial projection short and tooth-shaped	***teshi*** (p. 135)
–	Median cibarial projection long and rod-shaped	5
5	Cibarial teeth in radiating lines	***tubifer*** (p. 135)
–	Cibarial teeth not in radiating lines	6
6	Cibarial teeth very long and parallel	***frondifer*** (p. 134)
–	Cibarial teeth not very long and parallel	***pholetor*** (p. 134)
7	Pharynx with scale-like teeth	***longiforceps*** (p. 134)
–	Pharynx unarmed	8
8	Cibarial teeth all small	***stellae*** (p. 135)
–	Anterior cibarial teeth very long	***sejunctus*** (p. 135)

Males

1	Apical spine of style with marked basal expansion	***asperulus*** (p. 134)
–	Apical spine of style without such expansion	2
2	Style with three spines	3
–	Style with more than three spines	4
3	Coxite with the two non-distal spines at 0·39. Paramere nearly straight with bulbous apex	***erebicolus*** (p. 134)
–	Coxite with the two non-distal spines at 0·5 or 0·6, and 0·7. Paramere curved upward and pointed	***longiforceps*** (p. 134)
4	Style with four spines	***frondifer*** (p. 134)

– Style with five spines 5
5 Aedeagus prominent and capitate. Paramere slender and without dorsal appendage . ***pholetor*** (p. 134)
– Aedeagus small and triangular. Paramere with basal dorsal curved appendage . . ***stellae*** (p. 135)

Phlebotomus* (*Idiophlebotomus*) *asperulus Quate & Fairchild

(Map 1)

Phlebotomus (*Idiophlebotomus*) *asperulus* Quate & Fairchild, 1961: 208 [♀ ♂]; Lewis & Lane, 1976: 54; Lewis, 1978*b*: 250. Holotype ♂, WEST MALAYSIA (BPBM, Honolulu).

DISTRIBUTION. **West Malaysia**: Lewis (1978*b*: 251, map).

Phlebotomus* (*Idiophlebotomus*) *erebicolus Quate

(Map 1)

Phlebotomus (*Idiophlebotomus*) *erebicolus* Quate, 1965: 22 [♀ ♂]; Lewis & Lane, 1976: 57; Lewis, 1978*b*: 251. Holotype ♂, PHILIPPINES (BPBM, Honolulu).

♀. Leg formula, after Quate, 10, 186, 108; 92, 186, 106; 103, 203, 106.

Phlebotomus* (*Idiophlebotomus*) *frondifer Lewis & Lane

(Map 1)

Phlebotomus (*Idiophlebotomus*) *frondifer* Lewis & Lane, 1976: 57 [♀ ♂]; Lewis, 1978*b*: 251; Holotype ♂, WEST MALAYSIA (BMNH) [examined].

♀ (*extra fact*). Leg formula 100, 149, 91; 99, 167, 93; 103, 216, 101 (2·16, 0·89).

Phlebotomus* (*Idiophlebotomus*) *longiforceps (Wang, Ku & Yuan)

(Map 1)

Sergentomyia longiforceps Wang, Ku & Yuan, 1974: 334 [♀ ♂]. Holotype ♂, CHINA: Rongjiang (Chung-Kiang Hsien) (MC, Guiyang).
Phlebotomus longiforceps (Wang, Ku & Yuan) Lewis, Young, Fairchild & Minter, 1977: 326.
Idiophlebotomus longiforceps (Wang, Ku & Yuan) Xiong *et al*., 1980: 322 [intra-abdominal rods].

The description is in Chinese with an English summary, and some features are as follows.

♀. Cibarium and pharynx figured. Cibarium with more than 60 small triangular teeth in rows and no pigment patch. Pharynx with many wedge-shaped teeth of different sizes, arranged irregularly. Antenna 3 = 0·526 mm long, 1·82 length of 4 + 5, 2·3 length of labrum, 0·61 length of wing width. Palp formula 1, 4, 2, 5, 3; relative lengths 1 : 2·5 : 4 : 2 : 3. Wing figured, length 2·618 mm, 3·0 width (0·861 mm), R_1 overlap = +0·406 mm, M_{1+2} fork 0·105 mm beyond origin of R_4. Abdominal tergites 2–6 with many erect hairs. Spermatheca figured, rather large, carrot-shaped and unsegmented with irregular wrinkles.

♂. Cibarium and pharynx figured. Antenna 3 = 0·714 mm long, 1·76 length of 4 + 5, 2·69 length of labrum, two ascoids on 3–15. Palp ratio 1, 4, 2, 5, 3, relative lengths 1 : 2·37 : 4·5 : 1·87 : 2·95. Wing figured, length 2·356 mm, 3·17 width (0·742 mm), R_1 overlap = +0·280 mm, M_{1+2} fork = +0·091 mm beyond origin of R_4. Terminalia as figured (but with intra-abdominal rods); paramere single, and claw-shaped coxite approximately 2·4 length of style, with long hairs on apical half; style with three spines, one of them apical.

Phlebotomus* (*Idiophlebotomus*) *pholetor Quate & Fairchild

(Map 1)

Phlebotomus (*Idiophlebotomus*) *pholetor* Quate & Fairchild, 1961: 210 [♀ ♂]; Lewis & Lane, 1976: 57; Lewis, 1978*b*: 251. Holotype ♂, BORNEO: Sabah (BPBM, Honolulu).

♀ (*extra fact*, Sabah, 12.xi.1972). Leg formula 100, 149, 90; 95, 159, 90; 121, 187, 100 (2·13, 0·88).

DISTRIBUTION. **Borneo (Sabah) and Philippines**: Lewis (1978*b*: 236, map).

Phlebotomus (Idiophlebotomus) sejunctus (Quate)

(Map 1)

Phlebotomus (*Idiophlebotomus*) *sejunctus* Quate, 1965: 22 [♀]; Lewis, 1978*b*: 251. Holotype ♀, PHILIPPINES (BPBM, Honolulu).

Phlebotomus (Idiophlebotomus) stellae Quate

(Map 1)

Phlebotomus (*Idiophlebotomus*) *stellae* Quate, 1965: 20 [♀ ♂]; Lewis & Lane, 1976: 59; Lewis, 1978*b*: 251. Holotype ♂, PHILIPPINES (BPBM, Honolulu).

♂. Leg formula after Quate, 100, 135, 88; 97, 157, 91; 104, 185, 101 (0·84).

Phlebotomus (Idiophlebotomus) teshi Lewis

(Map 1)

Phlebotomus (*Idiophlebotomus*) *teshi* Lewis, 1978*b*: 252 [♀]. Holotype ♀, NEPAL: Pokhara (BPBM, Honolulu).

♀. Leg formula 100, 120, 90; 92, 156, 83; 96, 182, 134.

Phlebotomus (Idiophlebotomus) tubifer Lewis & Lane

(Map 1)

Phlebotomus (*Idiophlebotomus*) *tubifer* Lewis & Lane, 1976: 59 [♀]; Lewis, 1978*b*: 252. Holotype ♀, INDIA (BMNH) [examined].

DISTRIBUTION. **India**: Lewis (1978*b*: 326, map); G. B. Modi, 1979, pers. comm., Sagar in Shimoga district, ♀ ♂.

***Phlebotomus (Idiophlebotomus)* sp. A**

(Map 1)

This is being described by Lewis & Dyce and is placed here in accordance with the first letter of its future name.

Subgenus *AUSTRALOPHLEBOTOMUS* Theodor

Phlebotomus subgenus *Australophlebotomus* Theodor, 1946: 99; Quate & Quate, 1967: 11, 14. Type-species: *Phlebotomus brevifilis* Tonnoir, 1935, by original designation.
Phlebotomus brevifilis group; Fairchild, 1952: 192, 194, 196, 198, 199.

Key to the species of subgenus *Australophlebotomus*

Females

1 Pharyngeal teeth short, about 5 μm.
Spermathecal ducts wrinkled, outlets touching. Cibarium with about seven to nine main teeth and several laterals, arch strong with lateral bulges. Maxilla with more than 150 ventral teeth. Pharynx largely brown . . . . **brevifiloides** (p. 136)

– Pharyngeal teeth long, about 25 μm 2

2 Spermathecal ducts with sleletal lattice near furca.
Maxilla with about 150 ventral teeth. Pharynx brown in hind half . . . **brevifilis** (p. 136)

– Spermathecal ducts without such lattice . . . . **pexopharynx** (p. 136)

Males

1 Aedeagus very short, less than half as long as coxite 2

– Aedeagus long or rather long, more than half as long as coxite 3

2 Plunger of sperm pump wide. Genital filament with thin-walled tip opening backward **brevifilis** (p. 136)

– Plunger of sperm pump narrow. Genital filament with thick-walled tip opening somewhat downward . . . . ***brevifiloides*** (p. 136)
3 Genital filament 3·6 length of pump which has plunger without expanded base. Inter-arcal area much wider than long. . . . . ***trifilis*** (p. 137)
– Genital filament 1·2–1·8 length of pump which has plunger with normal expanded base. Inter-arcal area about as wide as long 4
4 Antenna 3 = 1·6 length of labrum. Aedeagus with straight tip . . . . . ***papuensis*** (p. 136)
– Antenna 3 = 1·1 length of labrum. Aedeagus with up-turned tip . . . . . ***buccinator*** (p. 136)

Phlebotomus **(*Australophlebotomus*) sp. B**

(Map 1)

This is being described by Lewis & Dyce.

Phlebotomus **(*Australophlebotomus*)** ***brevifilis*** Tonnoir

(Map 1)

Phlebotomus brevifilis Tonnoir, 1935: 145 [♀ ♂]; Fairchild, 1952: 192. Specimens stated by Tonnoir to be ♀ and ♂ types being studied by Lewis & Dyce, AUSTRALIA (ANIC, Canberra).
Phlebotomus (*Australophlebotomus*) *brevifilis* Tonnoir; Theodor, 1948: 100, 108.

DISTRIBUTION. **Australia**: information mainly from A. L. Dyce.

Phlebotomus **(*Australophlebotomus*)** ***brevifiloides*** Fairchild

(Map 1)

Phlebotomus brevifiloides Fairchild, 1952: 194 [♀]. Holotype ♀, AUSTRALIA (CIH, Sydney).

DISTRIBUTION. **Australia**: information mainly from A. L. Dyce.

Phlebotomus **(*Australophlebotomus*)** ***buccinator*** Fairchild

(Map 1)

Phlebotomus buccinator Fairchild, 1952: 194, 195, 205 [♂]. Holotype ♂, AUSTRALIA: Cairns (SPHTM, Sydney).

Phlebotomus **(*Australophlebotomus*) sp. C**

(Map 1)

This is being described by Lewis & Dyce.

Phlebotomus **(*Australophlebotomus*)** ***papuensis*** Fairchild

(Map 1)

Phlebotomus papuensis Fairchild, 1952: 200 & 193, 195, 203 [♂]. Holotype ♂, PAPUA NEW GUINEA: Dobadura (CIH, Sydney).
Phlebotomus (*Australophlebotomus*) *papuensis* Fairchild; Quate & Quate, 1967: 11.

Phlebotomus **(*Australophlebotomus*)** ***pexopharynx*** Fairchild

(Map 1)

Phlebotomus pexopharynx Fairchild, 1952: 196 [♀]; Quate & Quate, 1967: 14. Holotype ♀, AUSTRALIA: Cairns (CIH, Sydney).

Phlebotomus* (*Australophlebotomus*) *trifilis Quate & Quate

(Map 1)

Phlebotomus (*Australophlebotomus*) *trifilis* Quate & Quate, 1967: 11 [♂]. Holotype ♂, Papua New Guinea: Vogelkop (BPBM, Honolulu).

Note. This species is presumably named after the three spines on the style.

Subgenus ***PHLEBOTOMUS*** Rondani & Berté

Phlebotomus subgenus *Phlebotomus* Rondani & Berté; Theodor, 1948: 96; 1958: 16; Quate, 1964: 238; Perfil'ev, 1968: 62, 63, 65, 79, 227; Hennig, 1972: 24, 51, 53 [this subgenus, *Euphlebotomus* and *Anaphlebotomus* seem to be related to the fossil *P. tipuliformis* and should perhaps be united under a common name]; Lewis, 1978*b*: 231.

Key to the species of subgenus *Phlebotomus*

Females

1 Most pharyngeal scaly teeth arranged obliquely and pointing backward . . . ***bergeroti*** (p. 137)
– Most pharyngeal scaly teeth not pointing backward ***duboscqi*** (p. 138), ***papatasi*** (p. 138), ***salehi*** (p. 141)

Males

1 Upper process of paramere not longer than paramere 2
– Upper process of paramere longer than paramere 3
2 Upper process of paramere clothed with hairs on all sides . . . . . . ***duboscqi*** (p. 138)
– Upper process of paramere clothed with hairs on hind part . . . . ***salehi*** (p. 138)
3 Antenna 3 = 0·27 to 0·34 mm long. Wing length about 2·2–2·7 mm. Coxite long, 0·55 to 0·6 mm. Style 0·37–0·41 mm long, distance between basal and middle spines less than that between middle and distal spines. Eye appearing small because head relatively short . ***papatasi*** (p. 138)
– Antenna 3 = 0·24–0·28 mm long. Wing length about 1·8–2 mm long. Coxite not long, 0·37–0·4 mm. Style 0·27 mm long, distance between basal and middle spines greater than or equal to that between middle and distal spines. Eye appearing large because head relatively long. Distal spines of surstyle long and thin . . . . ***bergeroti*** (p. 137)

Phlebotomus* (*Phlebotomus*) *bergeroti Parrot

(Map 2)

Phlebotomus papatasi var. *bergeroti* Parrot, 1934: 383 [♂]; 1941*b*: 237 [♀]; Parrot & Bellon, 1952: 60. Syntypes 3 ♂, Algeria (IP, Algiers).

Phlebotomus (*Phlebotomus*) *viduus* Parrot, 1936*a*: 34 [♀]. Syntypes 3 ♀, Ethiopia (IP, Algiers?). [Synonymized by Theodor, 1948: 106.]

Phlebotomus (*Phlebotomus*) *bergeroti* Parrot; Lewis & Büttiker, 1980 [synonymy including description of ♀ by Bellon in 1936]; Perfil'ev, 1968: 66; Artemiev, 1978: 16.

♀ (*extra fact*, Yemen, Taiz, 29.xi.1970). Leg formula 100, 106, 68; 103, 136, 76; 120, 175, 93 (0·78).
♂ (*extra fact*, Saudi Arabia). Head 0·41 (0·38–0·43) mm long, 0·22 (0·22–0·23) length of wing (n = 5).

Distribution. **Africa**: Abonnenc & Rioux (1961: 35, map). **Africa, Mediterranean area etc.**: Abonnenc (1972: 255, map). **Djibouti area**: Courtois (1972). **Ethiopia**: Danakil ('Asaita', 4.i.1968, 2 ♀ biting man, *R. W. A.*); Humera (29.v.1968, 1 ♂, *R. W. A.*); Kirk & Lewis (1952: 339). **Iran**: Theodor & Mesghali (1964: 286). **Morocco**: Rioux *et al.* (1975: 495, map). **Saudi Arabia**: Lewis & Büttiker (1980, map). **Somalia**: Burao (1913? 1 ♂, *R. E. D. B.*). **South Yemen**: Pringle (1960, 'Mazu' and Yashbum, assumed to be Wadi Yeshbum); Ba Zulayfah (x.1962, *S. A. S.*, see under *P. papatasi*). **Sudan**: Lewis & Kirk (1951: 565; 1957: 632, revised list). **United Arab Emirates**: Al Ain (Ain al Faidr, 1980, *G. B. W.*, det. *R. P. L.*). **Yemen**: Lewis (1974).

Note. This species is thermophilic and xerophilic in Afghanistan (Artemiev, 1978: 16). It bites man readily and has been suspected of transmitting CL in the central Sahara and sandfly-fever in Ethiopia (Abonnenc, 1972: 95).

Phlebotomus (Phlebotomus) duboscqi Neveu-Lemaire

(Map 2)

Phlebotomus duboscqi Neveu-Lemaire, 1906: 65 [♀ ♂]; Austen, 1909: 20; Abonnenc, 1958: 61; 1959: 333; Abonnenc & Larivière, 1958: 260 [egg & larva]; Abonnenc & Rioux, 1961: 32; Ashford, 1974: 607. Syntypes 6 ♀, 6 ♂, MALI (depository unknown).

Phlebotomus duboscqi Neveu-Lemaire; Picard, 1909: 165. [Mis-spelling.]

[*Phlebotomus pappatasi* (Scopoli); Picard, 1909: 165. Misidentification, Abonnenc, 1958: 65.]

Phlebotomus duboscqii Neveu-Lemaire; Alcock, 1911: 119. [Mis-spelling.]

Phlebotomus duboscqui Neveu-Lemaire; Newstead, 1912: 367; 1913: 124; Summers, 1913: 114. [Mis-spellings.]

[*Phlebotomus papatasii* (Scopoli); Newstead, 1913: 125. Misidentification, Abonnenc, 1958: 65.]

Phlebotomus roubaudi Newstead, 1913: 125 [conditional name]; 1914: 187; Rageau, 1951: 794. Holotype ♂, MAURETANIA (IP, Paris?). [Synonymized by Larrousse, 1921: 44; Abonnenc, 1958: 65.]

Phlebotomus (*Phlebotomus*) *roubaudi* Newstead; Parrot & Gougis, 1944: 40; Kirk & Lewis, 1946*a*: 42; 1946*b*: 120; 1947: 875; 1951: 424; Kervran, 1946: 155; Lewis & Kirk, 1957: 634; Perfil'ev, 1968: 4.

Phlebotomus (*Phlebotomus*) *duboscqi* Neveu-Lemaire; Kirk & Lewis, 1946*a*: 41; 1951: 427; Perfil'ev, 1968: 4, 65, 66; Abonnenc, 1972: 95.

Phlebotomus roubaudi var. *fourtoni* Floch & Abonnenc, 1948: 1. Holotype ♂, UPPER VOLTA (depository unknown). [Synonymized by Abonnenc, 1958: 65.]

Phlebotomus (*Phlebotomus*) *roubaudi* var. *fourtoni* Floch & Abonnenc; Kirk & Lewis, 1951: 325; Lewis & Kirk, 1954: 34.

♀ (*extra fact*, Senegal, 1977–1978). Leg formula 100, 108, 61; 101, 106, 60; 126, 173, 98 (0·75).

DISTRIBUTION. **Africa etc.**: Abonnenc (1972: 255, map; 1973: 185, northernmost point 20° near Akjoujt, Mauretania). **Ethiopia**: Ashford (1974: 607); Gemetchu *et al.* (1976: 81). **Gambia**: Snow (1979). **Ghana**: Nangodi (10.iv.1962, ♂, *D. J. L.*). **Sudan**: Hoogstraal & Heyneman (1969: 1155); Lewis & Kirk (1951: 566, map; 1957: 632, revised list); Qutubuddin (1962: 594). **Togo**: Abonnenc (1973: 190, map).

In the Senegal River valley the finding by Dedet *et al.* (1980) of only 30 *P. duboscqi* and two *P. rodhaini* with 2245 *Sergentomyia* exemplified the paucity of *Phlebotomus* in the tropics.

NOTE. *P. duboscqi* is probably more primitive than *bergeroti* or *papatasi*; its distribution corresponds with that of CL in West Africa; it is common in dwellings in Upper Volta, and has been suspected as a vector in Niger (Abonnenc, 1972: 34, 99) and Senegal (Abonnenc, 1973: 185; Hoogstraal & Heyneman, 1969: 1170). Dedet *et al.* (1979: 435, 436) found it infected with *Le. major* in Senegal.

Phlebotomus (Phlebotomus) papatasi (Scopoli)

(Map 2)

Bibio papatasi Scopoli, 1786: 55 [♀]. Type(s), ITALY (U, Pavia?).

? *Musca papatasi* (Scopoli) Gmelin, 1790: 2866; Costa, 1843: 6; Sinton, 1928: 300. [Position uncertain.]

? *Ciniphes molesta* Costa, 1840: 2225; 1843: 4. Syntype(s), ITALY (depository unknown). [Synonymized by Sinton, 1928: 300; Kirk & Lewis, 1951: 422; Perfil'ev, 1968: 1, 7 [*P. molestus* from Asia], 228 [as '*Cyniphes molesta*'].] [Position uncertain.]

Flebotomus papatasii (Scopoli) Rondani, 1840: 13; Costa, 1843: 4, 6 [Terra di Otranto] [♂, short note on terminalia; Scopoli's description of fly superficial].

Hebotomus papatasii (Scopoli) Rondani, 1843: 265, pl. 10, recognizable figure of style).

Hebotomus molestus (Costa); Rondani, 1843: 266 [habitat Kingdom of Naples; quotes '*Cyniphes molesta* J. Costa' and '*Cyniphes* J. Costa'].

Phlebotomus papatasi (Scopoli) Loew, 1847: 151; Saccà, 1950: 684 [early stages]; Hemming, 1958: 16, 189 [in official list of specific names]; Abonnenc, 1958: 63; 1959: 329; Schmidt & Schmidt, 1963: 567; Bhat & Modi, 1976: 265; Lysenko & Beliaev, 1977*b*: 263 [variation]; Guevara-Benîtez, Ubeda-Ontiveros & Morillas-Marquez, 1978: 824, 832.

Musca papatasii (Scopoli); Rondani, 1856: 178.

Phlebotomus papatasii (Scopoli); Noé, 1905: 722; Grassi, 1907: 356 ['J. Costa' mentioned], 359, 384, [all Italian Phlebotominae thought to be one species]; 1908: 681 [two species known in Rome]; Summers, 1911: 105; Handlirsch, 1925: 96 [in list of names not to be changed]; Pierantoni, 1925: 4; Sinton, 1928:

300 [synonymy]; Patton & Evans, 1929: 101; Shchurenkova, Demina & Pavlova, 1929: 683; Isaev, 1935: 95, 103 [cibarium, spermatheca etc.]. [Mis-spellings.]

Phlebotomus pappatasi (Scopoli); Picard, 1909: 164. [Mis-spelling.]

Phlebotomus pappatasii (Scopoli); Mansion, 1913: 639. [Mis-spelling.]

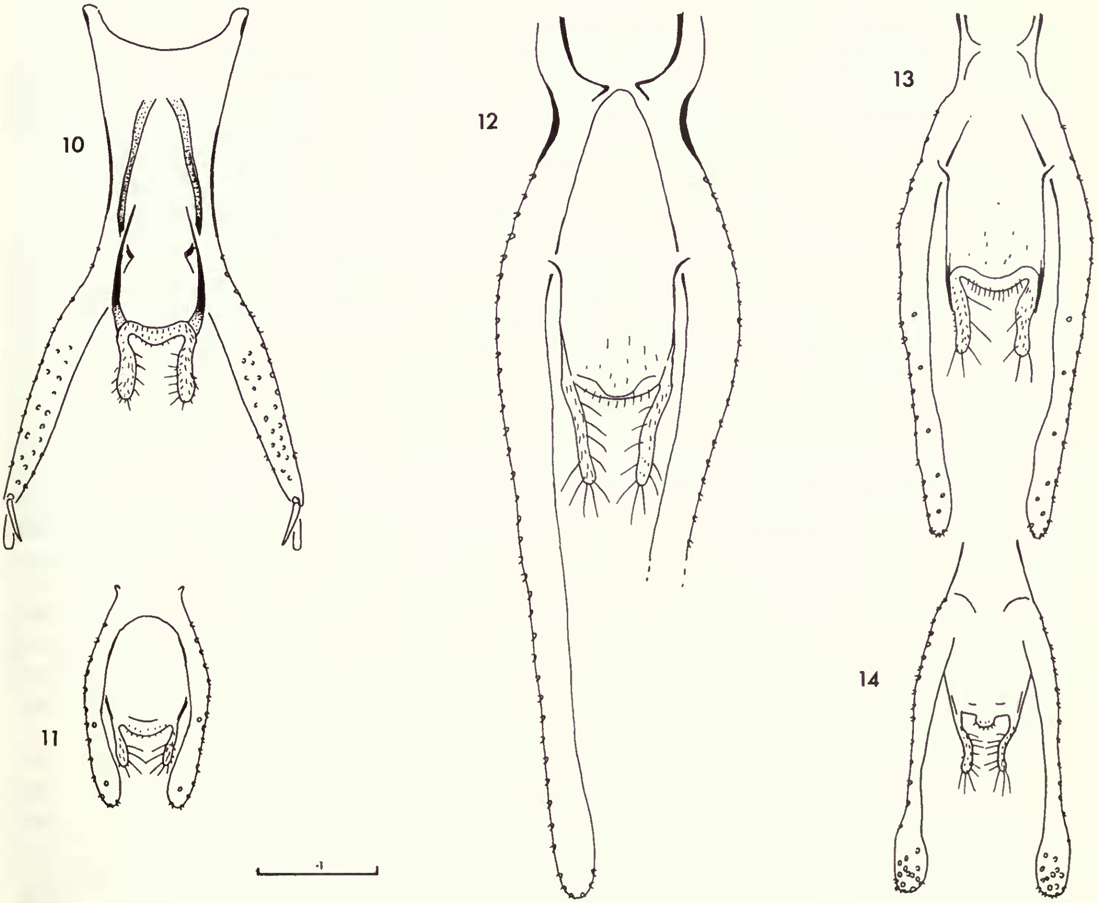
Phlebotomus (*Phlebotomus*) *papatasi* var. *breviventris* Ristorcelli, 1941: 369 [♀]. Syntypes 2 ♀, MOROCCO (depository unknown) [treated as former subspecies according to ICZN, 1974: Article 45 (e)]. **Syn. n.**

Phlebotomus (*Phlebotomus*) *papatasi* (Scopoli); Theodor, 1948: 86, 106, [genus and species in '*nomina conservanda*' of Handlirsch, 1925]; 1958: 17; Kirk & Lewis, 1951: 422 [synonymy, Handlirsch's list]; Parrot, 1953: 115. Fairchild, 1955: 188; Lewis & Kirk, 1957: 632; Quate, 1964: 240; Perfil'ev, 1968: 1, 5, 49 [larva], 50, 60 [egg], 62, 65, 66, 228; Croset, 1969: 360; Rioux & Golvan, 1969: 68; Bailly-Choumara, Abonnenc & Pastre, 1971: 436; Artemiev, 1972: 300 [spiracles]; Biocca, Coluzzi & Constantini, 1977*a*: 158, 160 [absent from Milan area and very rare in Italy where there are seven species]; 1977*b*: 31; Artemiev, 1978: 15; Lewis, 1978*b*: 233 [synonymy]; Croset, Rioux, Maistre & Bayar, 1978: 726, 732; Lewis & Büttiker, 1980.

Phlebotomus papatasi papatasi (Scopoli); Abonnenc & Rioux, 1961: 31 [in distinction from *bergeroti*].

♀ (*extra facts*). Leg formula (Hofuf, Saudi Arabia, n = 10): 100, 103·0 (96–108), 58·4 (55–62); 100·6 (98–103), 124·6 (114–133), 69·2 (64–74); 119·7 (117–123), 164·3 (154–174), 91·2 (87–96).

♂ (*extra facts*). Head 0·42 (0·38–0·42) mm long, 0·208 (0·20–0·21) length of wing (n = 5, Saudi Arabia). Leg formula (Hofuf, Saudi Arabia, n = 10): 100, 110·8 (104–117), 63·4 (57–79); 93·7 (67–103), 132·5 (124–135), 74·9 (69–78); 114·1 (110–118), 165·6 (158–175), 91·9 (80–97). Basitarsus 3/femur 3: India, 84·1 (79–86, n = 10); Saudi Arabia, 80·7 (71–87, n = 10).



Figs 10–14 Abdominal segment 9 of males of *Phlebotomus* species in dorsal view. (10) *P. papatasi*; (11) *P. alexandri*; (12) *P. guggisbergi*; (13) *P. hindustanicus*; (14) *P. argentipes*.

Distribution. **Western part of Old World**: Beklemishev & Dolmatova (1948: 354, map); Croset (1969: 275, map); Dolmatova & Demina (1971: 121, map); Hennig (1966: 59, 62, map to indicate marginal speciation); Lewis *in* Tesh *et al.* (1976: 666, map); Perfil'ev (1968: 89). **Africa, Mediterranean area etc.**: Abonnenc (1972: 255, map). **Indian subcontinent**: Lewis (1978*b*: 324, map). **Afghanistan**: Artemiev (1974: 157, map; 1978: 15); Arsenieva & Neronov (1978: 30, 32); Nadim *et al.* (1979: 33, Robatak, 36°09'N, 68°24'E). **Algeria**: Biskra (20.v.1893, *A. E. E.*); Dedet & Addadi (1977: 86); Dedet *et al.* (1977: 256). **Crete**: Hadjinicolaou (1958: 974, 975); Hertig (1949*a*: 782, 787–789. **Egypt**: Abu Aweigila (Sinai, vii.1979, *Y. S.*); Alexandria, Aswan, Asyut, Bahtim, Beni Suef, Giza, Imbaba, 'Kafra el Sheikh', Luxor, Maadi, Marsa Matruh, Matariya, Qaliubiya, Rashda, Sharqiyah and Tanta (1967, *M. A. R.*); Birqet Qarun (ix.1945, *R. L. C.*); Siwa (23.v.1935, *J. O. C.*); Zein el Dine (1972: 271, Dakhla oasis). **Ethiopia**: Gemetchu *et al.* (1977: 209). **France**: Colas-Belcour (1958: 826); Raynal (1954: 315, map); Rioux & Golvan (1969: 51, 72, maps). **Greece**: Hadjinicolaou (1958: 968–973); Hertig (1949*a*: 778, 779, 781–783, 786–789); Léger *et al.* (1979: 17); Volo (15.viii.1892, ♂, *E. M.*, sent to BMNH 18.viii.1892 by A. A. Merlin, H. M. Consul, Volo). **Hungary**: 'Carlapago' (12.vii.—, *K. K.*, bequeathed to BMNH in 1929 by *A. E. E.*). **India**: Modi *et al.* (1978: 748, map); Modi & Soman (1978: 159); Pandya *et al.* (1977: 133–135). **Iran**: Lewis, Mesghali & Djanbakhsh (1961: 206); Mesghali (1961: 26; 1963: 1073); Nadim, Mesghali & Javadian (1977: 215). **Iraq**: Ahmad (1976: 86, 96, 97); Amara (14.vi.1918, *P. A. B.*); Basra (x.1918, *H. W. L.*); Pringle (1953: 723, map). **Israel**: Adler & Theodor (1929: 271); Pazael, c. 31°67'N, 35°33'E, 12.vii.1979, *Y. S.*). **Italy**: Biocca *et al.* (1977*a*: 160, map; 1977*b*: 20, rare, 29, map); Corradetti *et al.* (1956*a*: 6, map); Hertig (1949*a*: 796); Maroli & Bettini (1977: 318). **Jordan**: Awjan (32°02'N, 36°04'E, 15.vii.1978, *E. K. S.*); Sweilah (32°02'N, 35°50'E, 2.vii.1978, *E. K. S.*). **Kuwait**: Al Fantas, 29°10'N, 48°06'E, Al Farwaniya area, 29°16'N, 47°55'E, 'Al Kazuma', Kuwait & 'Malboula', 1974, *K. B.*); Hussien & Behbehani (1976). **Libya**: Ashford *et al.* (1977: 265, Al Birkah, 32°05'N, 20°05'E, etc.); Nalut & Yafran area, 32°04'N, 12°31'E, *M. A.*). **Morocco**: Bailly-Choumara *et al.* (1971: 453, map); Gaud (1954: 95). **Oman**: Barka (x.1979, *G. S.*). **Pakistan**: Robinson & Blackham (1912). **Sardinia**: Hertig, 1949*a*: 798). **Saudi Arabia**: Lewis & Büttiker (1980, map). **Southern Yemen**: Amwadhia, 45°50'N, 13°46'E, Ba Tays, 13°20'N, 45°18'E, Ba Zulayfah, 13°50'N, 45°47'E, Dali, 13°42'N, 44°44'E, Khodad, 13°09'N, 44°50'E, Mukalla area, Nigda, 13°56'N, 45°55'E, Sah, 15°34'N, 48°51'E and Saywun area, 15°56'N, 49°27'E (1962, *S. A. S.*); 'Haski' (1939, ♂, *P.*); Sha'b Subeihi, 13°05'N, 44°30'E(?) (iv.1954, *N. L. C.*). **Spain**: Gil Collado (1977: 186, map); Guevara-Benîtez *et al.* (1978: 814); Najera (1937: 1488); Zariquiey (1944: 18). **Sudan**: Akasha, Dal Island, Ferka, Sai Island, 1980, *G. S.*); Hoogstraal & Heyneman (1969: 1544). **Syria**: Adler & Theodor (1929: 271); Arab Hassan, 36°30'N, 37°51'E, 'Halab Halwan', 'Kanat Albu', 'Klemis', 'Khan el Sobol', 'North Kena Halab' (1978, *K. Z. D.*). **Tunisia**: Chadli, Dancescu *et al.* (1970: 363); Dancescu, Romain *et al.* (1970: 357); Croset (1969: 273, map); Croset *et al.* (1978: 727, map); Dedet (1971: 157). **Turkey**: Yasarol (1980). **U.S.S.R.**: Gaibov (1975*a*: 55, Fergan area; 1976: 49, Surkhandar'ya area); Grebelsky (1937: 200, Khiva); Karapet'yan & Babayants (1979: 67, Bayram-Ali); Latyshev & Posyval (1937: 184, Seraks); Petrishcheva (1937: 148); Ponyrovskyi (1971: 495, Sumbar Valley). **Yemen**: Büttiker & Lewis (1979: 371). **Yugoslavia**: Trebinje (barracks, 24.vii.1908, *S. T.*); Živković (1972: 27).

Note. It is relevant to review briefly some aspects of the taxonomic history of this, the type-species of the genus and the first-known sandfly in the world, and an important disease vector. In pre-Linnaean times, in 1691, in Rome Philippo Bonanni (discussed by M. Lavoipierre in a paper cited by Theodor, 1948: 86, and Lewis, 1977: 94) published the first description of a (male) *Phlebotomus* but the species is unknown and may not have been *papatasi*. The next description, of a female of *Bibio papatasi* from the Milan area once known as Insubria, was published in 1786 in the city of Pavia, then in the Austrian Empire, by Johann Anton Scopoli (1723–1788), an eminent naturalist (Ambrosi, 1889; Gilbert, 1977; Higgins, 1963; Voss, 1881). The species was named from 'pappataci', the vernacular name for a sandfly, which means a silent gorger. A collection of Scopoli was probably destroyed by shipwreck and fire in 1766 (Horn & Kahle, 1935–1937); he was shipwrecked on the River Inn in Bavaria and had two fires in his house in Istria (Voss, 1882: 21). However, he probably studied *P. papatasi* later, when professor of chemistry and botany at the University of Pavia from 1776 to 1788 (Conci, 1975: 1013). The type is not in the NM, Vienna and is presumed to be lost. Schiner (1856: 405) praised Scopoli's work on Diptera, which had been disregarded until recently brought to light by English workers, but pointed out that some of his descriptions were out of date by modern standards. His figure of *P. papatasi* is rather crude.

In 1840, when *P. papatasi* was the only known sandfly in the World, '*C. molesta*', from Terra di Otranto, a former province around Otranto, was described by Giuseppe Costa, son of O. G. Costa (1787–1867), professor of zoology at Naples from 1836 to 1849 (Conci, 1975: 887). In 1843, in a paper in antiquated Italian, G. Costa linked the names *molesta* and *papatasi* but seemed to consider the species different, pointed out that *Ciniphes* was an ancient name [gnat in Latin, Bailey, 1828: 361] and that papatasio was the vulgar name for a notorious insect in parts of Lombardy. Also in 1843 Camillo Rondani, the eminent entomologist of Parma (Gilbert, 1977: 322; Meade, 1879: 138) figured the style of a species from central Italy which is now generally regarded as *P. papatasi*, gave the area of *H. molestus* as the Kingdom of Naples, and described another species of sandfly (*Sergentomyia minuta*) from the plain of Parma. Grassi (1907: 8), who referred to Rondani's descriptions as imperfect, recognized (Grassi, 1908) two species of *Phlebotomus* s. str. in Italy, and Biocca *et al.* (1977*a*) reported seven, stated that *P. papatasi* was very rare, and showed no record of it from Pavia. The listing of *P. papatasi* among 'nomina conservanda' did not settle the specific name because it was intended to decide on the generic name. It is uncertain whether *B. papatasi* (Scopoli, 1786) and *H. papatasii* (Rondani, 1843) were the same species but here, for practical reasons, the situation is regarded as stabilized and the synonymy as shown above.

The spelling *papatasii* is a mistake which lasted for more than a century.

The description of *P. p.* var. *breviventris* does not seem to justify its recognition as a taxon.

Small females (and males) are sometimes seen with a wing length much less than the 2·0 to 2·4 mm given by Theodor (1958: 18). For example, one from Israel (Pazael, 12.vii.1979) had a WL of 1·78 mm and width of 0·48 mm.

In the U.S.S.R. *P. papatasi* needs a warm summer and a mild winter, with a mean temperature not below −6°C and a short rainy season, and it has a limited altitude range (Perfil'ev, 1968: 89). In Afghanistan it is found up to 2100 m but occurs mainly in the plains where the water table is high (Artemiev, 1978: 15). This species is largely domestic over most of its range (Lewis & Büttiker, 1980) and, perhaps for this reason, is widespread and abundant. It is mainly domestic in France, Tunisia and Yugoslavia (Croset *et al.*, 1978: 726, 738) and Greece (Léger *et al.*, 1979: 19), and purely domestic in Spain (Gil Collado, 1977: 185). *P. papatasi* is much more anthropophilic than some species (Strelkova, 1974).

It has been suspected of transmitting VL in some areas where no likely vector was found (Lewis & Büttiker, 1980), including Iraq (Abul-hab & Azawi, 1978: 406; Adler, 1964: 79; Azawi & Abul-hab, 1976; Sukkar, 1972: 69) but is evidently a poor potential vector (Abonnenc, 1972: 100; Saf'yanova, 1967: 38; Williams & Coelho, 1978: 17), and another species may be responsible.

P. papatasi and *P. sergenti* are the main vectors of CL to man (Theodor, 1964: 488; Wilcocks & Manson-Bahr, 1972: 135). *P. papatasi* (according to Lysenko & Beliaev, 1977*b*: 262) and *P. caucasicus* transmit CL among rodents in Central Asia (Theodor, 1964: 489), and Saf'yanova (1977: 257, 259) has distinguished two types of zoonotic foci in the U.S.S.R., a dangerous one with *P. papatasi*, and another with *P. caucasicus* and *P. andrejevi* as vectors under different conditions. In some areas *P. papatasi* transmits zoonotic *Le. t. major* from animals to man (Adler, 1964: 67; Lysenko, 1971: 516; Mŏskovskij & Dukhanina, 1971: 732; Sergiev, 1979: 199). *P. papatasi* is the principal vector of zoonotic CL in Central Asia (Saf'yanova & Alekseev, 1977: 154) and appears to be the vector of CL in Iran (Adler, 1964: 791; Bray, 1974: 93; Javadian *et al.*, 1977: 203; Nadim & Rashti, 1971: 100), Saudi Arabia (Nadim, Rashti & Ashi, 1979), Afghanistan (Nadim, Javadian *et al.*, 1979) and India (Lewis, 1977: 134). This species is a troublesome biter and a well known vector of CL in many areas (Abonnenc, 1972: 100) including Israel (Molyneux, 1977: 49; Egoz & Michaeli, 1978) and the Mediterranean basin generally (Dedet, 1979: 72). It transmits sandfly fever.

Phlebotomus* (*Phlebotomus*) *salehi Mesghali

(Map 2)

Phlebotomus (*Phlebotomus*) *salehi* Mesghali, 1965: 264 [♂]; Mesghali & Rashti, 1968: 770 [♀]; Kalra & Lewis, 1976: 522; Lewis, 1978*b*: 235; Artemiev, 1978: 16. Holotype ♂, IRAN (IPH, Tehran).

[*Phlebotomus saheli* Mesghali; Killick-Kendrick, 1978: 300. Mis-spelling.]

♂ (*extra fact*, India). Leg formula 100, 113, 63; 122, 172, 98; 125, 170, 98 (0·74).

DISTRIBUTION. **India**: Lewis (1978*b*: 235, map). **Iran**: Mesghali & Rashti (1968: 768, 769, map); Nadim *et al.* (1977: 215).

NOTE. *P. salehi* probably transmits CL among rodents in India (Kalra & Lewis, 1976; Killick-Kendrick, 1978: 298).

Subgenus *PARAPHLEBOTOMUS* Theodor

Phlebotomus subgenus *Paraphlebotomus* Theodor, 1948: 97; 1958: 19; 1965: 175; Perfil'ev, 1968: 49 [larva], 63, 66, 80, 232; Abonnenc, 1972 [as *sergenti* group]; Lewis, 1978*b*: 235. Type-species: *Phlebotomus sergenti* Parrot, 1917, by original designation.

The inclusion of *P. kazeruni* necessitates the following slight change to Theodor's (1958) definition of the subgenus: 'usually the spermatheca segmented. . .; in *P. kazeruni* very short, unsegmented and expanded distally.'

Key to the species and subspecies of subgenus *Paraphlebotomus*

Females

1 Antenna 3 short (0·12–0·16 mm), 0·5–0·6 length of labrum . . . 2
– Antenna 3 long (0·22–0·33 mm), 0·7–1·0 length of labrum . . . 3
2 Armature about 0·17 length of pharynx with straight hind edge; pharynx conical with hind width 2·0–2·5 times fore width . . . ***alexandri*** (p. 143)
– Armature about 0·25 length of pharynx with distinctly concave hind edge and smaller teeth; pharynx bulging, with hind width 3–4 times fore width . . . ***marismortui*** (p. 146)
3 Spermatheca not segmented, its body about as long as wide. Mesonotum brown . . . ***kazeruni*** (p. 145)
– Spermatheca segmented, its body much longer than wide . . . 4
4 Pharyngeal teeth weakly developed, most obliquely arranged, occupying only fifth or sixth length of pharynx . . . ***andrejevi*** (p. 144), ***caucasicus*** (p. 144), ***mongolensis*** (p. 147)
– Pharyngeal teeth very distinct, hind ones rounded, most teeth pointing inward and posteriorly, armature usually occupying hind 0·16 or 0·20 of pharynx length . . . 5
5 Pharyngeal armature 0·15–0·17 length of pharynx . . . 6
– Pharyngeal armature 0·20–0·33 length of pharynx . . . 7
6 Antenna 3 = 0·44 mm long. Africa and Saudi Arabia . . . ***saevus*** (p. 147)
– Antenna 3 = 0·31–0·33 mm long. U.S.S.R. . . . ***sergenti similis*** (p. 148)
7 End segment of spermatheca bell-shaped on narrow stem. Pharyngeal teeth numerous . . . ***chabaudi*** (p. 145)
– End segment of spermatheca ring-like and sessile . . . 8
8 Spermatheca with four or five segments. Wing index 1·2–1·9 . . . ***sergenti sergenti*** (p. 147)
– Spermatheca with seven to nine segments . . . 9
9 Pharynx with eight or nine rows of four to five teeth. Antenna 3 about 0·23 mm long ***jacusieli*** (p. 145)
– Pharynx with 10–12 rows of six to eight teeth. Antenna 3 about 0·26–0·30 mm long . ***nuri*** (p. 146)

Males

1 Basal lobe of coxite with most of hairy surface ventral, lobe very large, about 40 μm wide ***caucasicus*** (p. 144)
– Basal lobe of coxite with all or most of hairs terminal . . . 2
2 Antenna 3 short (0·12–0·16 mm), 0·7–0·9 length of labrum. Sperm pump small (0·12 mm) with plunger slightly wider than barrel . . . 3
– Antenna 3 long (0·24–0·34 mm), 1·0–1·4 length of labrum. Sperm pump large (0·17–0·20 mm) with plunger much wider than barrel . . . 4
3 Style three times as long as thick, less than half as long as coxite. Two spines on style terminal ***marismortui*** (p. 146)
– Style four times as long as thick, more than half as long as coxite. One spine of style terminal, the next at 0·7 . . . ***alexandri*** (p. 143)
4 Aedeagus with a narrow tip . . . 5
– Aedeagus tip curving outward and slightly backward so that in side view it appears angular, prow-shaped or occasionally rounded . . . 6

5	Lobe of coxite large, about 0·080 mm long. Tip of aedeagus pointed	***saevus*** (p. 147)
–	Lobe of coxite small, about 0·034 mm long. Tip of aedeagus narrowly rounded	***chabaudi*** (p. 145)
6	Style less than half as long as coxite, three times as long as thick. Basal lobe of coxite slender, distinctly longer than thick	7
–	Style length equal to or more than half that of coxite	8
7	Basal lobe of coxite 0·06 mm long and 0·02 mm wide with small scarcely differentiated head. Surstyle 0·26–0·28 mm long	***sergenti sergenti*** (p. 147)
–	Basal lobe of coxite 0·07–0·08 mm long and 0·03 mm wide with rounded slightly differentiated head. Surstyle 0·31–0·32 mm long. U.S.S.R.	***sergenti similis*** (p. 148)
8	Style about half length of coxite, about four times as long as thick. Basal lobe of coxite about 0·03 mm wide. Tip of aedeagus appearing rounded or prow-shaped in side view	***kazeruni*** (p. 145)
–	Style longer than half length of coxite	9
9	Second spine of style at 0·7	10
–	Second spine of style at 0·8 or nearer tip	11
10	Style 3·3 times as long as wide	***mongolensis*** (p. 147)
–	Style 4·0 times as long as wide	***nuri*** (p. 146)
11	Style 0·35 length of coxite. Basal lobe of coxite 0·08 mm wide	***andrejevi*** (p. 144)
–	Style 0·53 length of coxite. Basal lobe of coxite 0·07 mm wide	***jacusieli*** (p. 145)

Phlebotomus* (*Paraphlebotomus*) *alexandri Sinton

(Map 3)

Phlebotomus sergenti var.; Newstead, 1920: 309 [♂]. [Synonymized by Sinton, 1928: 308.]
Phlebotomus sergenti var. *alexandri* Sinton, 1928: 308 [♂]; Adler, Theodor & Lourie, 1930: 533 [♀]. Lectotype ♂, IRAQ: Amara, 19.ix.1918 (*P. A. B.*) (BMNH), here designated [examined].
Phlebotomus (*Paraphlebotomus*) *alexandri* Sinton; Perfil'ev, 1968: 63, 67, 72–74, 241; Croset, 1969: 285; Artemiev, 1978: 17; Croset, Rioux, Maistre & Bayar, 1978: 728, 732; Lewis & Büttiker, 1980 [synonymy].
Phlebotomus (*Phlebotomus*) *alexandri* Sinton; Abonnenc, 1972: 102, 103 ['Localité type: Amara (Mésopotamie). Holotype: Déposé au B. M.']; Guevara-Benîtez, Ubeda-Ontiveros & Morillas-Marquez, 1978: 833.

♀ (*extra fact*, Saudi Arabia, Wadi Mizbil, 11.viii.1977). Leg formula 100, 94, 51; 99, 115, 62; 124, 153, 87 (1·72, 0·55).

DISTRIBUTION. **Africa, Mediterranean area etc.**: Abonnenc (1972: 256, map); Croset (1969: 289, map). **Afghanistan**: Artemiev (1974: 157, map); Nadim *et al.* (1979: 33, Robatak). **Algeria**: Dedet (1979, map in *litt.*); Dedet & Addadi (1977: 86); Rioux *et al.* (1970: 877). **China**: Xiong *et al.* (1964, Xinjiang); Wang *et al.* (1963, Gansu Province). **Cyprus**: Croset *et al.* (1978: 729). **Djibouti area**: Courtois (1972). **Ethiopia**: Gemetchu *et al.* (1977: 209). **Greece**: Hertig (1949*a*: 781, 784–786); Léger *et al.* (1979: 17). **Iran**: Lewis *et al.* (1961: 306); Mesghali (1961: 55, map); Nadim *et al.* (1977: 215); Theodor & Mesghali (1964: 286). **Iraq**: Ahmad (1976: 86, 98); Pringle (1953: 721). **Israel**: Theodor (1947: 95). **Pakistan**: Lewis (1978*b*: 325, map). **Rumania**: Duport *et al.* (1971: 387). **Saudi Arabia**: Lewis & Büttiker (1980, map). **Spain**: Rioux *et al.* (1974*a*: 121, map). **Tunisia**: Croset (1969: 287, map); Croset *et al.* (1970: 872; 1978: 727, map). **Turkey**: Houin *et al.* (1971: 638); Yasarol (1980). **United Arab Republic**: Al Ain (*G. B. W.*, 1980, Ain al Faidr, det. *R. P. L.*). **U.S.S.R.**: Croset *et al.* (1978: 728, Crimea); Gaibov (1975*a*: 55; 1975*b*, Fergan area); Karapet'yan & Babayants (1979: 67, Bayram-Ali, 37°37′N, 62°10′E); Latyshev & Pozyvai (1937: 184); Petrishcheva (1935: 206; 1937: 148); Rasnitsyna (1974). **Yemen**: Lewis (1974*b*).

NOTE. Newstead cited two males of '*sergenti* var.' and also six females which prove to be another species. All eight are in the BMNH.

In Afghanistan *P. alexandri* is mainly a mountain species, is thermophilic and somewhat hydrophilic, and bites man readily (Artemiev, 1978: 17). It may play some part in VL transmission in China (Xiong *et al.*, 1963*b*: 610), and is considered to be an important vector of CL in the southern U.S.S.R. (Dedet, 1979: 72; Petrishcheva, 1971: 573). Females have been found infected with flagellates in a CL area of Iran (Javadian *et al.*, 1977: 203, 204) and the species is suspected of transmitting CL in Tunisia (Croset *et al.*, 1978: 729), owing to its relationship to *P. sergenti*.

Phlebotomus* (*Paraphlebotomus*) *andrejevi Shakirzyanova

(Map 3)

Phlebotomus sergenti var. *andrejevi* Shakirzyanova, 1953: 103 [♀ ♂]; Gaibov, 1956: 63. Syntypes ♀, about 760 (10 per cent of 7613), U.S.S.R. (depository unknown).

Phlebotomus (*Paraphlebotomus*) *andrejevi* Shakirzyanova; Theodor & Mesghali, 1964: 286 [till then unknown outside the U.S.S.R.]; Perfil'ev, 1968: 67, 72, 249; Croset, Abonnenc & Rioux, 1970: 867; Lewis, 1971: 535 [close to *caucasicus*]; Artemiev, 1974: 159.

Phlebotomus (*Paraphlebotomus*) *mofidii* Theodor & Mesghali, 1964: 289; Croset, Abonnenc & Rioux, 1970: 867. Holotype ♂, IRAN (BMNH) [Synonymized by Artemiev, 1978: 18.]

DISTRIBUTION. **Afghanistan**: Artemiev (1974: 157, map; 1978: 18). **Iran**: Theodor & Mesghali (1964: 287, 290, north-east, partly as *mofidii*). **Mongolia**: Artemiev (1978: 18); Neronov & Gunin (1978: 23, Bayan-Khongorsk, 45°30′N, 99°30′E, central, eastern and southern Gobi). **U.S.S.R.**: Dergacheva (1974: 1668, Karshinskaya Steppe); Dergacheva & Turzhanova (1977, Mangyshlak Peninsula); Dergacheva & Zerikhina (1974: 425); Karapet'yan & Babayants (1979: 67, Bayram-Ali); Perfil'ev (1968: 251, Alma Ata Province and Kzyl-Orda); Rasnitsyna (1974); Theodor & Mesghali (1964: 287, 290).

NOTE. In the U.S.S.R. (Eliseev & Dergacheva, 1972) and in Afghanistan (Artemiev, 1978: 18) this species occurs mainly in sandy deserts, and in south-east Turkmenia it and *P. caucasicus* live in drier areas than *P. papatasi*, according to Saf'yanova (1979: 78). In the U.S.S.R. (Dubrovsky, 1976; Sergiev, 1979: 199) *P. andrejevi* plays a major part in disseminating *Le. tropica major*.

Phlebotomus* (*Paraphlebotomus*) *caucasicus Marzinowsky

(Map 3)

Phlebotomus (*Hebotomus, Haemasson*) *grimmi* Porchinski, 1876: 32 [♂]; Perfil'ev, 1968: 11. Type(s), U.S.S.R.: Baku (depository unknown). [A senior synonym which should be suppressed; discussed below.]

Phlebotomus caucasicus Marzinowsky, 1917: 613 [♂]; Popov, 1926: 241; 1935: 108; Marzinowsky & Shchurenkova, 1929: 67; Adler, Theodor & Lourie, 1930: 531; Isaev, 1935: 103 [cibarium]; Perfil'ev, 1935: 98. Type(s), U.S.S.R. (U, Moscow?).

[*Phlebotomus sergenti* Parrot; Newstead, 1920: 307 [♀]; Nasonov, 1926: 240. Misidentifications.]

Phlebotomus li Popov, 1926: 241; Khodukin, 1929: 92; Sinton, 1928: 309; Shchurenkova, 1929*a*: 674. Syntypes 18 ♂, U.S.S.R.: Armenia (MI, Moscow?). [Synonymized by Marzinowsky & Shchurenkova, 1929: 673.]

Phlebotomus grimmi Porchinsky; Perfil'ev, 1937 [status not clear]; 1960: 271 [regarded as a senior synonym of *caucasicus*]; 1968: 7, 11, 236 [description of coxite insufficient for identification; specific independence first discussed by Nasonov.]

Phlebotomus sergenti var. *lii* Popov; Popov, 1928: 33.

Phlebotomus selectus Khodukin, 1929: 99. Syntypes ♀ ♂, U.S.S.R.: Andizhan (US, Tashkent?). [Synonymized by Perfil'ev, 1968: 236.]

Phlebotomus (*Paraphlebotomus*) *grimmi* Porchinsky; Perfil'ev, 1963: 69; 1968: 1, 7, 49 [larva], 50, 62, 67, 72, 74, 233.

Phlebotomus (*Paraphlebotomus*) *caucasicus* Marzinowsky; Theodor, 1958: 19; Theodor & Mesghali, 1964: 287 [identity of *grimmi* uncertain]; Perfil'ev, 1968: 11; Croset, Abonnenc & Rioux, 1970: 864; Artemiev, 1974: 158; 1978: 18; Lewis, Young, Fairchild & Minter, 1977: 326 [discussion].

♀ (*extra fact*, Iran, Abs Forushan, 5.vii.1969). Leg formula 100, 114, 72; 100, 131, 79; 121, 175, 98 (0·96); tibia 3 = 176 in ♂.

DISTRIBUTION. **Afghanistan**: Artemiev (1974: 157, map); Nadim *et al.* (1979: 33, Robatak). **China**: Xiong *et al.* (1964, Xinjiang). **Iran**: Lewis *et al.* (1961: 206); Mesghali (1961: 25, map); Theodor & Mesghali (1964: 288, species mainly in the north). **U.S.S.R.**: Beklemishev & Dolmatova (1948: 358, map); Dergacheva (1974: 1668, Karshinskaya steppe); Dergacheva & Zerikhina (1974: 524); Gaibov (1975*a*: 55, Fergan area); Grebelsky (1937: 200, Khiva); Karapet'yan & Babayants (1979: 67, Bayram-Ali); Khodukin (1929, Tashkent); Latyshev & Posyvai (1937: 184, Serakhs); Marzinowsky & Shchurenkova (1929: 672); Perfil'ev (1968: 89, 236, Andizhan, Baku and Tashkent); Petrishcheva (1937: 148); Ponirovsky (1971: 495, Sumbar Valley); Rasnitsyna (1974); Zakhar'yants (1958).

NOTE. The above citations are selected from the complex taxonomic history of this species. Artemiev (1976, in *litt.*) called it *caucasicus* because, before Perfil'ev's (1960) paper, the name *grimmi* had been out of use for more than 50 years. During the 49 years from 1925 to 1973 the *Zoological Record* cited *caucasicus* seven times and *grimmi* not at all. In 1975 and 1976 the *Review of applied Entomology* (Series B) did not mention *grimmi*, but recorded citations of *caucasicus* by 11 authors in 11 publications, and two other citations by one of the authors. I propose to request the ICZN to suppress the name *grimmi* according to Articles 23 (a–b) and 79 (1973).

This species occurs in moderately hot and dry regions (Perfil'ev, 1968: 89), and was considered to transmit VL in Central Asia and Kazakhstan (Sergiev, 1979: 208). It plays a major part in disseminating *Le. tropica major* in the U.S.S.R. (Dubrovsky, 1976: 275; Hoare, 1949: 167; Lewis, 1977: 134; Lysenko, 1971: 516; Sergiev, 1979: 199, 208). Perfil'ev (1968: 139) reported that it probably transmitted *Le. tropica* among rodents while the relatively anthropophilic *P. papatasi* and *P. sergenti* passed it on to man. It has been found infected with flagellates in gerbil burrows in Iran (Nadim & Rashti, 1971: 100) and may transmit CL among gerbils in Afghanistan (Nadim *et al.*, 1979: 33).

***Phlebotomus* (*Paraphlebotomus*) *chabaudi* Croset, Abonnenc & Rioux**

(Map 3)

Phlebotomus (*Paraphlebotomus*) *chabaudi* Croset, Abonnenc & Rioux, 1970: 864 [♂]; Rioux, Croset & Guy, 1970: 877; Croset, Léger, Abonnenc & Rioux, 1974: 104 [♀]; Rioux, Croset & Léger, 1974: 506; Dedet & Addadi, 1974: 309 [♀]; Rioux, Croset, Léger, Benmansur & Soussi, 1975: 497; Croset, Rioux, Maistre & Bayar, 1978: 729, 732. Holotype ♂, TUNISIA (IP, Paris).

Phlebotomus chabaudi Croset, Abonnenc & Rioux; Guevara-Benîtez, Ubeda-Ontiveros & Morillas-Marquez, 1978: 833.

♀. Leg formula after Dedet & Addadi, 100, 128, 80; 93, 143, 83; 114, 183, 108 (0·94).

DISTRIBUTION. **Algeria**: Dedet (1979, map in *litt.*); Dedet & Addadi (1974: 308, Biskra; 1977: 86); Rioux *et al.* (1970: 877, Ghardaia). **Morocco**: Rioux *et al.* (1974: 99, 100, map; 1975: 495, map). **Spain**: Rioux *et al.* (1974*b*: 505, map). **Tunisia**: Croset *et al.* (1970: 872, map; 1978: 727, map, 731).

NOTE. *P. chabaudi* is suspected of being a vector of CL in North Africa (Croset *et al.*, 1978: 731; Dedet, 1979: 72).

***Phlebotomus* (*Paraphlebotomus*) *jacusieli* Theodor**

(Map 3)

Phlebotomus (*Paraphlebotomus*) *jacusieli* Theodor, 1947: 95 [♂]; 1958: 20 [♀]; Theodor & Mesghali, 1964: 288; Croset, Abonnenc & Rioux, 1970: 867; Artemiev, 1974: 158, 161; Artemiev & Dergacheva, 1978: 84 [old records of '*mongolensis*' from Transcaucasia wrong, and refer to *jacusieli* which occurs at Agdam in Azerbayzhan]. Holotype ♂, ISRAEL (BMNH).

DISTRIBUTION. **Iran**: Theodor & Mesghali (1964: 288); Nadim *et al.* (1977: 215). **Israel**: Theodor (1947: 95, Rosh Pinna). **Turkey**: Yasarol (1980). **U.S.S.R.**: Artemiev (1974: 160); Artemiev & Dergacheva (1978: 87).

***Phlebotomus* (*Paraphlebotomus*) *kazeruni* Theodor & Mesghali**

(Map 3)

Phlebotomus (*Paraphlebotomus*) *kazeruni* Theodor & Mesghali, 1964: 289 [♂ (♀ = *sergenti*)]; Nadim & Mesghali, 1968: 239 [♀]; Croset, Abonnenc & Rioux, 1970: 867; Artemiev, 1974: 158; 1978: 17; Lewis & Büttiker, 1980. Holotype ♂, IRAN (IPH, Tehran).

♀ (*extra fact*, Saudi Arabia). Leg formula 100, 117, 72; 100, 135, 72; 118, 175, 103.

DISTRIBUTION. **Afghanistan**: Artemiev (1974: 157, map). **Iran**: Nadim & Mesghali (1968: 240, map); Theodor & Mesghali (1964: 289, Kazerun). **Saudi Arabia**: Lewis & Büttiker (1980, map).

Note. In Afghanistan *P. kazeruni* occurs mainly in deserts and low rocky mountains (Artemiev, 1978: 17). In Saudi Arabia it seems common enough to play a part in transmitting *Leishmania* among rodents.

Phlebotomus* (*Paraphlebotomus*) *marismortui Theodor

(Map 4)

Phlebotomus (*Paraphlebotomus*) *maris-mortui* Theodor, 1947: 92 [♀ ♂]; 1958: 21. Syntypes 4 ♀, 1 ♂, Israel (BMNH).

The spelling is emended according to ICZN (1964) Articles 26 (a) and 32.

Phlebotomus* (*Paraphlebotomus*) *mongolensis Sinton

(Map 4)

Phlebotomus 'C'; Young & Hertig, 1926: 611. China (5 ♀, 6 ♂ in BMNH). [Synonymized by Patton & Hindle, 1926: 405.]

Phlebotomus sergenti var.; Patton & Hindle, 1926: 408 [♀ ♂]. China (1 ♀ in BMNH). [Synonymized by Theodor & Mesghali, 1964: 290.]

Phlebotomus sergenti var. *mongolensis* Sinton, 1928: 309 [♂]; Raynal, 1937: 53 [♀ ♂, first full description]. Type(s), China: North.

Phlebotomus (*Paraphlebotomus*) *mongolensis* Sinton; Theodor, 1958: 21; Theodor & Mesghali, 1964: 290 [synonymy]; Perfil'ev, 1968: 63, 67, 72–74, 246; Croset, Abonnenc & Rioux, 1970: 864; Artemiev, 1974: 159; 1978: 18.

Phlebotomus (*Paraphlebotomus*) *imitabilis* Artemiev, 1974: 158. Syntypes 2 ♀, 2 ♂, Afghanistan: 16 km north of Kabul (MI, Moscow). [Synonymized by Artemiev, 1978: 18.]

The reference to *sergenti* var. under *P. alexandri* is relevant.

♀ (*extra fact*, China, 7.ix.1927). Leg formula 100, 114, 68; 100, 131, 77; 124, 169, 97.

Distribution. **Afghanistan**: Artemiev (1974: 157, as *imitabilis*; 1978: 18). **China**: Beijing area (1916 or before, *R. A. B.*); Patton & Hindle (1926: 409, Xuzhou, = Hsu-chowfu); Raynal (1937: 58, Beijing and Nanjing); Wang *et al.* (1963, Gansu Province desert area); Young & Hertig (1926: 611). **Iran**: Mesghali (1961: 33, map); Nadim *et al.* (1977: 215); Theodor & Mesghali (1964: 291). **Mongolia**: Artemiev (1978: 18, Bayan-Khongorsk, central and southern Gobi, and Tsagan-Bogdo which is 42°50′N, 50°50′E). **U.S.S.R.**: Artemiev (1978: 18, Kazakhstan); Dergacheva (1974: 1668, Karshinskaya steppe); Dergacheva & Turzhanova (1977, Mangyshlak Peninsula); Dergacheva & Zerikhina (1974: 424); Sorokin (1978, lower River Emba). Many early records are omitted owing to identification problems.

Note. This species seems to be a poor vector (Adler, 1964: 81; Garnham, 1974: 225; Molyneux, 1977: 48; Saf'yanova, 1967: 10) of *Le. donovani*, but was stated by Sergiev (1979: 208) to be a main vector of VL in Central Asia and Kazakhstan. It plays a major part in disseminating *Le. t. major* in the U.S.S.R. (Dubrovsky, 1976: 275; Lewis, 1977: 134; Sergiev, 1979: 199) where it transmits the infection among rodents (Bray, 1972: 40; Fischer, 1978: 102). It was found infected with flagellates in gerbil burrows in Iran (Nadim & Rashti, 1971: 100).

Phlebotomus* (*Paraphlebotomus*) *nuri Lewis

(Map 4)

Phlebotomus (*Paraphlebotomus*) *nuri* Lewis, 1967: 15 [♂]; 1978*b*: 236; Artemiev, 1974: 160, 161; 1978: 17 [♀]. Holotype ♂, Pakistan (BMNH) [examined].

♂ (*extra fact*, Pakistan, Said Pur, 6.vi.1959). Leg formula 100, 137, 89; 94, 162, 99; 111, 196, 119 (0·83).

Distribution. **Southern Afghanistan and southern Iran**: Artemiev (1978: 17). **Pakistan**: Lewis (1978*b*: 325, map).

Note. In Afghanistan *P. nuri* occurs rarely in southern rocky mountains (Artemiev, 1978: 18).

Phlebotomus (Paraphlebotomus) saevus Parrot

(Map 4)

Phlebotomus sergenti var. *saevus* Parrot & Martin, 1939: 484 [♀ ♂]. Syntypes 5 ♀, 1 ♂, ETHIOPIA (one in IP, Algiers; Abonnenc, 1972: 103).

Phlebotomus (*Paraphlebotomus*) *saevus* Parrot & Martin; Büttiker & Lewis, 1980 [synonymy].

♀ (*extra fact*, Saudi Arabia, Wadi Mizbil, 4.vii.1977). Leg formula 100, 127, 84; 93, 145, 86; 110, 175, 103 (0·95).

DISTRIBUTION. **Africa**: Abonnenc (1972: 256, map). **Ethiopia**: Ashford (1974: 607). **Kenya**: Minter (1964: 207, map). **Saudi Arabia**: Lewis & Büttiker (1980).

Phlebotomus (Paraphlebotomus) sergenti Parrot

Phlebotomus sergenti Parrot, 1917: 564.

Represented by two subspecies.

Phlebotomus (Paraphlebotomus) sergenti sergenti Parrot

(Map 4)

Phlebotomus sergenti Parrot, 1917: 564 [♂]; França, 1918: 731 [♀]; Khodukin, 1929: 92; Patton & Evans, 1929: 195, 227; Isaev, 1935: 103 [cibarium]; Abonnenc & Larivière, 1957 [larva]; Ashford, 1964: 607 [great variation in antenna 3 may indicate two species]; Guevara-Benîtez, Ubeda-Ontiveros & Morillas-Marquez, 1978: 825, 833. Syntypes ♂, ALGERIA (one in IP, Algiers; Abonnenc, 1972: 105).

? *Phlebotomus crimicus* Shtefko & Minkevich, 1923: 52; Nasonov, 1926: 54 [original depository unknown, description poor, may be *P. sergenti*]; Perfil'ev, 1968: 253. Syntypes 1 ♀, 1 ♂, U.S.S.R. (MH, Simferopol?). [Position doubtful.]

[*Phlebotomus caucasicus* Marzinowsky; Popov, 1925: 90. Misidentification according to Marzinowsky & Shchurenkova, 1929: 672.]

Phlebotomus (*Phlebotomus*) *sergenti* Parrot; Abonnenc & Larivière, 1957: 395; Abonnenc, 1972: 105 [table of differences of ♀ and ♂ from *P. alexandri* and *P. saevus*].

Phlebotomus (*Paraphlebotomus*) *sergenti* Parrot; Perfil'ev, 1968: 8, 9, 49 [larva], 50, 60 [egg], 67, 72–74, 81, 236; Croset, 1961: 281; Rioux & Golvan, 1969: 72; Biocca, Coluzzi & Constantini, 1977*b*: 162; Lewis, 1978*b*: 236 [synonymy]; Artemiev, 1978: 16; Croset, Rioux, Maistre & Bayar, 1978: 731, 732.

Phlebotomus (*Paraphlebotomus*) *sergenti sergenti* Parrot; Lewis & Büttiker, 1980: 263 [synonymy].

♀ (*extra fact*, U.S.S.R., Akhsunskiyi, 1966). Leg formula 100, 119, 76; 97, 137, 80; 116, 168, 103 (0·94).

DISTRIBUTION. **West of Old World**: Croset (1969: 283, map). **Africa, Mediterranean area etc.**: Abonnenc (1972: 256, map). **Orient**: Lewis (1978*b*: 325, map). **Afghanistan**: Arsenieva & Neronov (1978: 32); Artemiev (1974: 157, map); Nadim *et al.* (1979: 33, Robatak). **Algeria**: Dedet (1979, map in *litt.*); Dedet & Addadi (1977: 86); Dedet *et al.* (1977: 256). **Crete**: Hadjinicolaou (1958: 974, 975); Hertig (1949*a*: 782, 787–789). **Egypt**: Sharqiya Division (1967, *M. A. R.*); Theodor (1947: 91, Maadi). **France**: Rioux & Golvan (1969: 82). **Greece**: Hadjinicolaou (1958: 968, 970–973); Hertig (1949*a*: 779, 781); Léger *et al.* (1979: 17). **Iran**: Lewis *et al.* (1961: 206); Mesghali (1961: 33, map); Nadim, Mesghali & Javadian (1977: 215); Theodor & Mesghali (1964: 291, rare in south). **Iraq**: Ahmad (1976: 86, 98); Pringle (1953: 723, map). **Israel**: Theodor (1947: 91). **Italy**: Biocca *et al.* (1977*a*: 161, map; 1977*b*: 20, 29, map). **Jordan**: Awajan (32°02′N, 36°04′E, 20.x.1978, *E. K. S.*). **Lebanon**: Theodor (1947: 91). **Libya**: Ashford *et al.* (1977: 266, Bir Ayyad area). **Mali**: Ranque *et al.* (1975, few near Bamako). **Portugal**: França (1918: 731). **Saudi Arabia**: Lewis & Büttiker (1980, map). **Somali Republic**: Ranque *et al.* (1975: 4, 1600 m). **Southern Yemen**: Pringle (1960: 19). **Spain**: Gil Collado (1977: 186, map); Guevara-Benîtez *et al.* (1978: 814); Najera (1937: 1489); Zariquiey (1944: 19). **Syria**: 'Khan el Solol' (1970, caves, wells and pits, *K. Z. D.*); Theodor (1947: 91, Damascus). **Tunisia**: Chadli, Dancescu *et al.* (1970: 364); Chadli, Romain *et al.* (1970: 358); Croset (1969: 281, map); Croset *et al.* (1978: 735, map). **Turkey**: Houin *et al.* (1971: 635); Yasarol (1980). **U.S.S.R.**: Gaibov (1975*a*: 55; 1975*b*, Fergan area; 1976: 491, Surkhandar'ya area); Karapet'yan & Babayants (1979: 67, Bayram Ali). **Yemen**: Lewis (1974); Büttiker & Lewis (1979: 370). **Yugoslavia**: Simić & Živković (1956: 383, Makedonija).

NOTE. *P. sergenti* is less sensitive to temperature than *P. papatasi* and can stand colder winters and extends further north (Perfil'ev, 1968: 80). In Tunisia (Croset *et al.*, 1978: 734) it is common both in houses and out of doors, unlike *P. papatasi.* In Afghanistan (Artemiev, 1978: 17) it is moderately thermophilic and hydrophilic and bites man readily, usually indoors, and in many areas is the main vector of *Le. t. tropica* in numerous villages and towns. In the U.S.S.R. it is the main vector of anthroponotic CL (Sergiev, 1979: 206). It transmits CL in Crete (Molyneux, 1977: 49), is probably the vector of *Le. t. tropica* in Iran (Nadim & Rashti, 1971: 102; Nadim *et al.*, 1977) and Yugoslavia (Lupascu *et al.*, 1977: 192), and is the main vector in Iraq (Baghdad) and India (Abonnenc, 1972: 108).

***Phlebotomus* (*Paraphlebotomus*) *sergenti similis* Perfil'ev**

(Map 4)

Phlebotomus (*Paraphlebotomus*) *sergenti similis* Perfil'ev, 1963: 75 [♀ ♂]; 1968: 239, 251, 252. Syntypes ♀, ♂, U.S.S.R. (ZI, Leningrad?).

The spermathecae are said to be usually larger than those of *P. s. sergenti.* The status of this form needs to be reexamined in view of Perfil'ev's (1968: viii & 17) remarks on subspecies.

DISTRIBUTION. **U.S.S.R.**: Dzhavadov *et al.* (1978: 143, Dzhalilabad and Tazakent, in Azerbaydzhan); Perfil'ev (1963: Caucasus, Pyatagorsk, southern Crimea and southern Ukraine).

Subgenus ***SYNPHLEBOTOMUS*** Theodor

Phlebotomus subgenus *Synphlebotomus* Theodor, 1948: 97; 1958: 22; Perfil'ev, 1968: 66; Lewis & Ledger, 1976: 406; Lewis, 1978*b*: 236. Type-species: *Phlebotomus martini* Parrot, 1936, by original designation.

Key to the species of subgenus *Synphlebotomus*

Females

1 Ventral plates of pharynx with coarse teeth which obscure most of dorsal spiculate armature. Ascoid on antenna 3 about 0·3 length of segment. India, Iran . . . . **eleanorae** (p. 149)
– Ventral plates of pharynx with armature which does not obscure most of dorsal spiculate armature 2
2 Spermatheca with 12 segments. Iran . . . . **ansarii** (p. 149)
– Spermatheca with six to 10 segments 3
3 Ascoid on antenna 4 about half length of segment. Pharynx with few non-spiculate ridges . . . . **rossi** (p. 150)
– Ascoid on antenna 4 more than 0·6 length of segment and reaching its tip 4
4 Spermatheca with six segments . . . . **grovei** (p. 149)
– Spermatheca with eight or more segments . **celiae** (p. 149), **martini** (p. 150), **vansomerenae** (p. 150)

Males

1 Coxite lobe with about 80 hairs. Iran . . . . **ansarii** (p. 149)
– Coxite lobe with about 30 hairs or less 2
2 Coxite lobe with about 30 filiform hairs of unequal lengths which increase from base of lobe to apex, the four apical hairs being distinctly longer than the others . . . . **katangensis** (p. 149)
– Coxite lobe with not more than 20 hairs 3
3 Coxite lobe with four or five postero-dorsal stout hairs which, in normal curved position, are 1·4 length of style; about nine postero-ventral short narrow ones present. Paramere with long dorsal row of stout sinuous hairs . . . . **rossi** (p. 150)
– Coxite lobe with longest hairs same length as style or less 4
4 Coxite lobe small and bearing about 10 subequal hairs. India, Iran . . . . **eleanorae** (p. 149)
– Coxite lobe bearing 15–22 subequal hairs 5
5 Coxite lobe with longest hairs same length as style. Paramere with a few short nearly straight rather thick hairs near tip . . . . **grovei** (p. 149)
– Coxite lobe with longest hairs 0·8 length of style or less 6
6 Coxite lobe with seven flat spatulate hairs and some thin ones . . . . **celiae** (p. 149)
– Coxite lobe without spatulate hairs 7
7 Coxite lobe with six flat hairs and about 12 thin shorter ones . . . . **martini** (p. 150)
– Coxite lobe with 10 flat hairs ending in filiform points, and some thin ones . **vansomerenae** (p. 150)

Phlebotomus* (*Synphlebotomus*) *ansarii Lewis

(Map 5)

Phlebotomus (*Phlebotomus*) *ansarii* Lewis, 1957: 689 [♀ ♂]. Holotype ♂, IRAN (BMNH) [examined].
Phlebotomus (*Synphlebotomus*) *ansarii* Lewis; Theodor, 1958: 22; Mesghali, 1961: 37; Lewis & Ledger, 1976: 406; Artemiev, 1978: 25.

♂ (*extra fact*). Leg formula 100, 112, 66; 106, 135, 76; 122, 169, 93 (1·67, 0·62).

DISTRIBUTION. **Iran**: Mesghali (1961: 56, map); Theodor & Mesghali (1964: 291).

NOTE. *P. ansarii* has been found infected with flagellates in gerbil burrows in Iran (Nadim & Rashti, 1971: 100) where it is involved in the transmission of zoonotic CL (Bray, 1972: 40).

Phlebotomus* (*Synphlebotomus*) *celiae Minter

(Map 5)

Phlebotomus (*Phlebotomus*) *celiae* Minter, 1962: 457 [♀ ♂]; Abonnenc & Minter, 1965: 32; Abonnenc, 1972: 110. Holotype ♂, KENYA (BMNH) [examined].
Phlebotomus (*Synphlebotomus*) *celiae* Minter; Lewis & Ledger, 1976: 406.

♀ (*extra fact*). Leg formula 100, 106, 65; 104, 127, 76; 122, 162, 94 (1·87, 0·67).

NOTE. *P. celiae* transmits VL in Kenya (Lysenko, 1971: 517; Mutinga, 1975: 340; Perfil'ev, 1968: 142). It and *P. vansomerenae* are indistinguishable from *P. martini* in the female sex, so their roles are not fully known.

Phlebotomus* (*Synphlebotomus*) *eleanorae Sinton

(Map 5)

Phlebotomus eleanorae Sinton, 1931*a*: 817 [♂]; 1933: 418. Holotype ♂, INDIA (BMNH) [examined].
Phlebotomus (*Synphlebotomus*) *eleanorae* Sinton; Mesghali, 1965: 267 [♀]; Lewis & Ledger, 1976: 405; Lewis, 1978*b*: 217 [synonymy]; Artemiev, 1978: 25.

♂ (*extra fact*, holotype). Leg formula 100, 106, 64; 110, 140, 78; 126, 172, 94 (1·68, 0·60).

DISTRIBUTION. **India**: Sinton (1931: 817). **Iran**: Mesghali (1935: 269).

Phlebotomus* (*Synphlebotomus*) *grovei Downes

(Map 5)

Phlebotomus (*Synphlebotomus*) *grovei* Downes, 1971: 283; [♀ ♂]; Lewis & Ledger, 1976: 406. Holotype ♂, NAMIBIA (SAIMR, Johannesburg).

♀ (*extra fact*). Leg formula 100, 105, 71, – – –, 123, 167, 100 (0·69).

DISTRIBUTION. **Namibia**: Ledger (1977: 58, map).

Phlebotomus* (*Synphlebotomus*) *katangensis Bequaert & Walravens

(Map 5)

Phlebotomus katangensis Bequaert & Walravens, 1930: 35 [♂]. Syntypes 2 ♂, ZAIRE: Lubumbashi (= Elizabethville) (MRAC, Tervuren).
Phlebotomus (*Synphlebotomus*) *katangensis* Bequaert & Walravens; Lewis & Ledger, 1976: 407 [synonymy & citations].

P. rossi was treated as a synonym of *P. katangensis* by some authors for several years.

Phlebotomus (Synphlebotomus) martini Parrot

(Map 5)

Phlebotomus (Phlebotomus) martini Parrot, 1936: 35 [♀ ♂]. Syntypes 9♀, 2 ♂, ETHIOPIA (one in IP, Algiers; Abonnenc, 1972: 117).

Phlebotomus (Synphlebotomus) martini Parrot; Lewis & Ledger, 1976: 406 [synonymy].

♀ (*extra fact*, Kenya). Leg formula 100, 116, 72; 102, 135, 75; 117, 157, 84 (0·68).

DISTRIBUTION. **Africa**: Abonnenc (1972: 117). **Kenya**: Kangondi (termite hill record from *D. M. M.*, 1980); Minter (1964: 207, map); Wijers & Ngoka (1974: 26). **Sudan**: Lewis & Kirk (1954: 35, map); Qutubuddin (1962: 594). **Uganda**: Wykoff *et al.* (1969).

NOTE. The work of Minter and colleagues showed that *P. martini* transmits VL in Kenya (Adler, 1964: 87; Bray, 1972: 40; Diesfeld, 1978: 50; Manson-Bahr, 1971: 434; Perfil'ev, 1968: 142; Southgate, 1977: 245; Wilcocks & Manson-Bahr, 1972: 122). It is uncommon in western Tharaka but may be the vector there (Mutinga & Ngoka, 1975; Wijers & Ngoka, 1974: 29). It may transmit the disease in south-west Ethiopia (Fuller *et al.*, 1979: 429).

Phlebotomus (Synphlebotomus) rossi De Meillon & Lavoipierre

(Map 5)

Phlebotomus rossi De Meillon & Lavoipierre, 1944: 44 [♂]; Parrot, 1957: 49 [proposed as synonym of *P. katangensis*]. Holotype ♂, ZIMBABWE (SAIMR, Johannesburg).

Phlebotomus (Phlebotomus) rossi De Meillon & Lavoipierre; Minter, 1962: 459; Abonnenc, 1967: 4; 1972: 112.

Phlebotomus (Synphlebotomus) rossi De Meillon & Lavoipierre; Mesghali, 1965: 269; Downes, 1971: 284; Lewis & Ledger, 1976: 407 [♀, reinstated as species; synonymy]; Ledger, 1977: 578.

♀ (*extra fact*, Namibia, Sandmodder, 18.iv.1975). Leg formula 100, 113, 66; 105, 137, 75; 120, 170, 93 (2·39, 0·28).

DISTRIBUTION. **Southern Africa**: Lewis & Ledger (1976: 410). **Namibia**: Ledger (1977: 582, map).

NOTE. In Namibia *P. rossi* lives in damp hyrax burrows and has been found infected with flagellates in an area of CL (Ledger, 1977: 579).

Phlebotomus (Synphlebotomus) vansomerenae Heisch, Guggisberg & Teesdale

(Map 5)

Phlebotomus (Phlebotomus) vansomerenae Heisch, Guggisberg & Teesdale, 1956: 211 [♀ ♂]. Holotype ♀, KENYA (BMNH) [examined].

Phlebotomus (Synphlebotomus) vansomerenae Heisch, Guggisberg & Teesdale; Lewis & Ledger, 1976: 406 [synonymy].

DISTRIBUTION. **Kenya**: Minter (1964: 207); Wijers & Ngoka (1974: 26).

NOTE. This species may transmit kala-azar in western Tharaka (Wijers & Ngoka, 1974: 28).

Subgenus *LARROUSSIUS* Nitzulescu

Phlebotomus subgenus *Larroussius* Nitzulescu, 1931: 274; Theodor, 1948: 97; 1958: 22; Perfil'ev, 1968: 63, 73, 82, 250, 252; Lewis, Minter & Ashford, 1974: 435; Biocca, Coluzzi & Constantini, 1977: 162 [trochanter spines in two groups in four species]; Lewis, 1978*b*: 237; Artemiev, 1980: 1181. Type-species: *Phlebotomus major* Annandale, 1910, by original designation.

Key to the species and subspecies of subgenus *Larroussius*

Females

1 Spermatheca with indistinct segmentation and no neck. Pharynx with large irregular teeth . 2
– Spermatheca with distinct segmentation and neck. Pharynx with punctiform teeth 3
2 Palpal segments 2 and 3 each 0·18–0·20 mm long . . . . . . ***mascittii mascittii*** (p. 158)

– Palpal segments 2 and 3 each 0·22–0·24 mm long . . . . . ***mascittii canaaniticus*** (p. 158)

3 Spermatheca with neck about as long as head . . . . ***somaliensis*** (p. 162)

– Spermatheca with neck much longer than head 4

4 Spermathecal ducts bag-like for most of their length . . . . ***gibiensis*** (p. 154)

– Spermathecal ducts mainly tubular 5

5 Pharyngeal teeth not very fine, in regular transverse rows, occupying nearly half the pharynx. Spermatheca with about 15 segments. Iran and Turkestan . . . . . . ***wenyoni*** (p. 163)

– Pharyngeal teeth very fine and punctiform 6

6 Spermatheca very long with 30–35 segments. Pharyngeal teeth bigger in middle than at sides ***kandelakii burneyi*** (p. 154), ***kandelakii kandelakii*** (p. 154)

– Spermatheca with 8–22 segments 7

7 Spermatheca with 18–22 segments 8

– Spermatheca with 8–16 segments 9

8 Spermatheca with about 22 segments, long neck and a very small head. Pharynx with scarcely visible spicules. West Malaysia . . . . ***betisi*** (p. 153)

– Spermatheca with 18–21 segments, broad at end and narrowing towards base, end process (neck and head) relatively short, about three times as long as wide. Hind half of pharynx with fine punctiform teeth which become scale-like anteriorly . . . . . . ***keshishiani*** (p. 155)

9 Outer 0·43 of spermathecal ducts sac-like. Pharyngeal armature occupying 0·15–0·17 length of pharynx. Antenna 3 = 0·38–0·42 mm long . . . . ***ariasi*** (p. 153)

– Spermathecal ducts not like this 10

10 Wing length usually 1·8–2·5 mm 11

– Wing length usually 2·8–3·6 mm 13

11 Spermatheca with 10 (8–12) segments . ***longicuspis*** (p. 155), ***orientalis*** (p. 159), ***perniciosus*** (p. 161)

– Spermatheca with 12–16 segments 12

12 Palpal formula 1, 4, 2, 3, 5 . . . . ***perfiliewi perfiliewi*** (p. 160), ***perfiliewi transcaucasicus*** (p. 161)

– Palpal formula 1, 2, 4, 3, 5 . . . . ***tobbi*** (p. 162)

13 Armature occupying half length of pharynx . . . . ***major krimensis*** (p. 156)

– Armature occupying about a third to a quarter length of pharynx 14

14 Armature occupying about hind third or more of pharynx, fore teeth scale-like with secondary spicules 15

– Armature occupying about hind quarter of pharynx 17

15 Armature occupying hind third of pharynx. Palpal formula 1, 4, (2, 3), 5 . . ***major major*** (p. 157)

– Armature of pharynx extending further forward. Palpal formula 1, 4, 2, 3, 5 16

16 Wing about 3·5 mm long . . . . ***major neglectus*** (p. 157)

– Wing about 2 mm long . . . . ***major syriacus*** (p. 157)

17 Hind teeth of pharyngeal armature relatively large . . . . ***guggisbergi*** (p. 154)

– Hind teeth of pharyngeal armature not relatively large 18

18 Most of pharyngeal armature comprising rows of fused denticles . . . . ***smirnovi*** (p. 162)

– Most of pharyngeal armature comprising distinct denticles ***aculeatus*** (p. 153), ***longipes*** (p. 156), ***pedifer*** (p. 159)

Males

1 Aedeagus with distal long slightly-curved transparent process bearing fine dorsal teeth . . . 2

– Aedeagus otherwise 4

2 Transparent part of aedeagus narrow and nearly straight, aedeagus 0·16 mm long ***perfiliewi transcaucasicus*** (p. 161)

– Transparent part of aedeagus narrow and curved, or broad 3

3 Two ascoids on antenna 3–15. Aedeagus 0·13–0·14 mm long, transparent process short and wide with four or five teeth concentrated near tip . . . . . ***perfiliewi perfiliewi*** (p. 160)

– Two ascoids on antenna 3–15. Aedeagus 0·17–0·19 mm long, transparent process long and narrow with teeth evenly spread . . . . ***perfiliewi galilaeus*** (p. 160)

4 Aedeagus with ventral teeth in the middle, and narrowing gradually to a point 5

– Aedeagus with smooth sides and no ventral teeth 6

5 Two ascoids on antenna 3–5 . . . . ***kandelakii kandelakii*** (p. 154)

– Two ascoids on antenna 3–7 . . . . ***kandelakii burneyi*** (p. 154)

6 Aedeagus with rounded end 7

– Aedeagus with sharp tip and nearly parallel sides 18

7 Aedeagus with marked distal bulge thickest at 0·84, distinctly shorter than paramere, with sperm tubes emerging at tip . . . 8

– Aedeagus with bulge nearer base or with none or virtually none . . . 9

8 Coxite 0·33 mm long, 1·9 length of aedeagus, with 16–32 hairs in tuft. Aedeagus clapper-like, with moderate subapical expansion . . . ***ariasi*** (p. 153)

– Coxite 0·48 mm long, three times length of aedeagus, with 37–78 hairs in group. Aedeagus sword-like, with thick subapical expansion and nearly pointed tip . . . ***chadlii*** (p. 153)

9 Aedeagus gradually thickening from each end till 0·6. Afrotropical . . . ***gibiensis*** (p. 154)

– Aedeagus without marked local thickening . . . 10

10 Length of aedeagus 7·8–11·0 middle thickness . . . 11

– Length of aedeagus 13–26 middle thickness . . . 14

11 Coxite about 6·9 as long as thick. Afrotropical . . . ***fantalensis*** (p. 154)

– Coxite about 4·6 or less as long as thick. Palaearctic . . . 12

12 Paramere with inconspicuous mid-ventral row of about four spines . . . ***smirnovi*** (p. 162)

– Paramere with conspicuous mid-ventral row of about ten spines . . . 13

13 Style rather longer than half length of coxite. Surstyle longer than coxite. Antenna 3 = 0·45 mm long, 1·55 length of labrum . . . ***mascittii mascittii*** (p. 158)

– Style less than half length of coxite. Surstyle not longer than coxite. Antenna 3 = 0·37–0·40 mm long, 1·3–1·5 length of labrum . . . ***mascittii canaaniticus*** (p. 158)

14 Aedeagus clearly shorter than paramere, sperm tubes emerging from tip . . . 15

– Aedeagus nearly as long as paramere, sperm tubes emerging before tip.
Two ascoids on antenna 3–8 . . . 16

15 Aedeagus narrowing towards tip. Coxite hair-group with 18–30 hairs.
Sperm tubes 6–11 times length of pump. . . . ***keshishiani*** (p. 155)

– Aedeagus with scarcely visible subapical swelling. Coxite hair-group with 25–30 hairs ***mariae*** (p. 158)

16 Teeth occupying nearly half length of pharynx, relatively large and in regular transverse rows ***wenyoni*** (p. 163)

– Teeth occupying only a third of length of pharynx, fine and punctiform.
Tip of aedeagus like drum-stick . . . 17

17 Coxite 0·33–0·35 mm long, style 0·16–0·19 mm long . . . ***major neglectus*** (p. 157)

– Coxite 0·40–0·45 mm long, style 0·20–0·22 mm long . . . 18

18 Palpal formula 1, 4, (2, 3), 5 . . . ***major major*** (p. 157)

– Palpal formula 1, 4, 2, 3, 5 . . . 19

19 Coxite hair-group with more than 20 widely spaced hairs. Style less than half length of coxite ***major krimensis*** (p. 156)

– Coxite hair-group with about 30 densely packed hairs. Style half as long as coxite ***major syriacus*** (p. 157)

20 Aedeagus bifid . . . 21

– Aedeagus not bifid . . . 22

21 Both points of aedeagus the same size and sharp. Sperm pump 0·14–0·15 mm long ***perniciosus*** (p. 161)

– Distal point of aedeagus distinctly longer than the other and rounded. Sperm pump 0·05–0·18 mm long.
Both middle spines of style nearer basal spine than in *perniciosus*. Style longer than coxite. Aedeagus narrowing more markedly from the base, and more conical . . . ***tobbi*** (p. 162)

22 Hair group of coxite on low pad . . . ***guggisbergi*** (p. 154)

– Hair group of coxite not on pad . . . 23

23 Aedeagus with one to three subterminal spicules . . . ***aculeatus*** (p. 153)

– Aedeagus without subterminal spicules . . . 24

24 Tip of aedeagus tapering gradually, far from that of paramere except in *P. longicuspis* . . . 25

– Tip of aedeagus tapering abruptly, near that of paramere . . . 27

25 Tip of aedeagus curving downward. North Africa . . . ***longicuspis*** (p. 155)

– Tip of aedeagus curving upward. North-east tropical Africa . . . 26

26 Tip of aedeagus curving slightly upward . . . ***longipes*** (p. 156)

– Tip of aedeagus curving sharply upward . . . ***pedifer*** (p. 159)

27 Antenna 3–12 with two ascoids. Tip of aedeagus ventral and mesad . . . ***langeroni*** (p. 155)

– Antenna 3–7 with two ascoids. Tip of aedeagus dorsal and laterad . . . ***orientalis*** (p. 159)

Phlebotomus* (*Larroussius*) *aculeatus Lewis, Minter & Ashford

(Map 6)

Phlebotomus species C; Ashford, 1974: 610 [♀].

Phlebotomus (*Larroussius*) *aculeatus* Lewis, Minter & Ashford, 1974: 437 [♀ ♂; differences between Ethiopian and Kenyan forms noted]. Holotype ♂, KENYA (BMNH) [examined].

Phlebotomus (*Larroussius*) *elgonensis* Ngoka, Madel & Mutinga, 1975: 132. Holotype ♂, KENYA (NM, Nairobi). **Syn. n.**

NOTE. The descriptions of *aculeatus* and *elgonensis* tally fairly well but there are a few discrepancies in the description of the latter. The palp formulae of both sexes do not agree with the lengths of segments given; and in the paratype male, which the authors kindly placed in the BMNH, there are two ascoids on antenna 3–7 only, and $R_2/_{2+3}$ is 2·3 and not 0·88. The two appear to be the same species.

DISTRIBUTION. **Ethiopia and Kenya**: Lewis *et al.* (1974: 439). **Kenya**: Ngoka *et al.* (1975: 132, 136, three caves cited for holotype of *P. elgonensis*).

Phlebotomus* (*Larroussius*) *ariasi Tonnoir

(Map 6)

Phlebotomus ariasi Tonnoir, 1921*b*: 53 [♂]; Nitzulescu, 1930*d*: 531; Raynal & Le Gac, 1933: 652 [♀; Parrot, 1934: 386; 1936: 48; Najera, 1936: 309; Zariquiey, 1937: 410; Rageau & Colas-Belcour, 1956: 235; Abonnenc & Larivière, 1957: 392 [larva]; Rioux, Abonnenc & Bauduoy, 1965: 615; Croset, 1969: 349; Bailly-Choumara, Abonnenc & Pastre, 1971: 436; Biocca, Coluzzi & Constantini, 1977*a*: 162; Croset, Rioux, Maistre & Bayar, 1978: 734; Guevara-Benîtez, Ubeda-Ontiveros & Morillas-Marquez, 1978: 817, 832. Holotype ♂, SPAIN (depository unknown, believed lost).

Phlebotomus (*Larroussius*) *ariasi* Tonnoir; Theodor, 1958: 23; Juminer & Gibily, 1966: 86; Rioux & Golvan, 1969: 22, 88 [review]; Dedet & Dib, 1972: 56; Rioux, Croset, Léger & Benmansur, 1974: 96; Rioux, Croset, Léger, Benmansur & Soussi, 1975: 499; Biocca, Coluzzi & Constantini, 1977*a*: 160–162; 1977*b*: 30; Croset, Rioux, Maistre & Bayar, 1978: 734.

♀. Leg formula, after Zariquiey. 100, 133, 86; 138, 149, 104; 107, 183, 116 (0·98).

DISTRIBUTION. **Western Mediterranean**: Croset (1969: 357, map); Rioux & Golvan (1969: 89, 99, map). **Algeria**: Dedet (1979, map in *litt.*); Dedet & Addadi (1977: 86); Dedet, Addadi & Lannuzel (1977: 256); Parrot (1936: 48); Parrot & Clastrier (1939: 633). **France**: Croset (1969: 353, map); Dedet & Dib (1973: 55, 57–61, map); Houin *et al.* (1977: 113, map, 114, Juigné-sur-Sarthe, 47°52′N, 0°17′W); Rioux & Golvan (1969: 51, 89, 100, map). **Italy**: Biocca *et al.* (1977*a*: 160, map; 1977*b*: 20, 28, map); Rioux *et al.* (1964: 966). **Morocco**: Bailly-Choumara *et al.* (1971: 453, map). **Portugal**: Meira & Ferreira (1944: 274, map). **Spain**: Gil Collado (1977: 186, map); Guevara-Benîtez *et al.* (1978: 815); Najera (1937: 1488); Rioux & Golvan (1969: 100, map); Zariquiey (1944: 19). **Tunisia**: Croset (1969: 355, map); Croset *et al.* (1966: 549, map; 1978: 733, map); Rioux *et al.* (1966: 88, map, rare in humid areas; 1974: 505, map).

NOTE. *P. ariasi* has been readily infected with the parasites of VL (Molyneux, 1977: 48) and is the vector of *Le. donovani* in the south of France (Killick-Kendrick, 1978: 301; Lanotte *et al.*, 1977: 126; Molyneux, 1977: 48; Rioux *et al.*, 1977: 299, 303; Zuckerman & Lainson, 1977: 73).

Phlebotomus* (*Larroussius*) *betisi Lewis & Wharton

(Map 6)

Phlebotomus (*Larroussius*) *betisi* Lewis & Wharton, 1963: 117 [♀]; Lewis, 1978*b*: 237. Holotype ♀, WEST MALAYSIA (BMNH) [examined].

DISTRIBUTION. **West Malaysia**: (Lewis, 1978*b*: 237, map).

Phlebotomus* (*Larroussius*) *chadlii Rioux, Juminer & Gibily

(Map 6)

Phlebotomus (*Larroussius*) *chadlii* Rioux, Juminer & Gibily, 1966: 83 [♂]; Croset, Rioux, Juminer & Tour, 1966: 547; Croset, 1969: 342; Rioux & Golvan, 1969: 96; Rioux, Guy, Corroller, Croset & Addadi, 1970:

101 [♀ unknown]; Rioux, Croset, Léger & Bailly-Choumara, 1974: 96, 97; Rioux, Croset, Léger, Benmansur & Soussi, 1975: 498; Croset, Rioux, Maistre & Bayar, 1978: 735 [♀ unknown]. Holotype, TUNISIA (EM, Montpellier).

♂. Leg formula, Tunisia, after Rioux *et al.* (1966: 85). 100, 142, 96; 88, 162, 100; 104, 200, 125 (1·20).

DISTRIBUTION. **Algeria**: Dedet (1979, in *litt.*); Dedet & Addadi (1977: 86); Dedet *et al.* (1977: 256). **Morocco**: Rioux *et al.* (1974: 99, 100; 1975: 495, map). **Tunisia**: Croset *et al.* (1978: 733, map); Dedet (1971: 157); Rioux *et al.* (1966: 83, 88, in arid areas).

Phlebotomus* (*Larroussius*) *fantalensis Lewis, Minter & Ashford

(Map 6)

Phlebotomus species B; Ashford, 1974: 610 [♂].
Phlebotomus (*Larroussius*) *fantalensis* Lewis, Minter & Ashford, 1974: 439 [♂]. Holotype ♂, ETHIOPIA (BMNH) [examined].

Phlebotomus* (*Larroussius*) *gibiensis Lewis, Minter & Ashford

(Map 6)

Phlebotomus species A; Ashford, 1974: 610.
Phlebotomus (*Larroussius*) *gibiensis* Lewis, Minter & Ashford, 1974: 439 [♀ ♂]. Holotype ♂, ETHIOPIA (BMNH) [examined].

Phlebotomus* (*Larroussius*) *guggisbergi Kirk & Lewis

(Map 6)

Phlebotomus (*Synphlebotomus*) *guggisbergi* Kirk & Lewis, 1952: 339, 340 [♀ ♂]. Lectotype ♂, KENYA (BMNH), designated by Lewis, Minter & Ashford, 1974: 440 [examined].
Phlebotomus guggisbergi Kirk & Lewis; Lewis & Minter, 1960: 352.
Phlebotomus (*Phlebotomus*) *guggisbergi* Kirk & Lewis; Abonnenc & Minter, 1965: 31; Abonnenc, 1972 [in '*Synphlebotomus*' group].
Phlebotomus (*Larroussius*) *guggisbergi* Kirk & Lewis; Lewis, Minter & Ashford, 1974: 440.

DISTRIBUTION. **Kenya**: Minter (1964: 207, map; 1966: 180, map). **Tanzania**: Minter (1964: 208). **Uganda**: Kidepo Park (ix.1969, received from *D. M. M.* in 1980).

NOTE. This very large species is found in caves and among trees and bites man (Abonnenc, 1972: 112).

Phlebotomus* (*Larroussius*) *kandelakii Shchurenkova

Phlebotomus kandelakii Shchurenkova, 1929*b*: 693; Perfil'ev, 1968: 78, 261.

Phlebotomus* (*Larroussius*) *kandelakii burneyi Lewis

(Map 6)

Phlebotomus (*Larroussius*) *kandelakii burneyi* Lewis, 1967: 17 [♀ ♂]; 1978*b*: 238; Artemiev, 1974: 160. Holotype ♂, PAKISTAN (BMNH) [examined].

DISTRIBUTION. **Pakistan**: Lewis (1978*b*: 238, map).

Phlebotomus* (*Larroussius*) *kandelakii kandelakii Shchurenkova

(Map 6)

Phlebotomus sp. n.; Shchurenkova, Demina & Pavlova, 1929: 681, 684, 686, 688.
Phlebotomus kandelakii Shchurenkova, 1929*b*: 693 [♀ ♂]; Adler, Theodor & Lourie, 1930: 536. Syntypes ♀ ♂, U.S.S.R. (TI, Tbilsi).

Phlebotomus (*Larroussius*) *kandelakii* Shchurenkova; Theodor, 1958: 23; Perfil'ev, 1968: 261; Lewis, 1978: 237; Artemiev, 1978: 19.

DISTRIBUTION. **Central Asia**: Dolmatova (1962: 461, map); Dolmatova & Demina (1971: 120, map). **Afghanistan**: Artemiev (1974: 157, map; 1978: 19). **Iran**: Mesghali (1961: 47, map); Nadim & Rashti (1978: 27, Chahar Mahal); Theodor & Mesghali (1964: 291, only in north). **Lebanon**: Theodor & Mesghali (1964: 291). **Turkey**: Artemiev (1978: 19); Yasarol (1980). **U.S.S.R.**: Gaibov (1975*b*, Fergana area); Petrishcheva (1937: 148).

NOTE. In Afghanistan *P. kandelakii* is very hydrophilic and moderately thermophilic and bites man and large animals readily (Artemiev, 1978: 19). It appears to be a vector of *Le. donovani* in Georgia (Maruashvili, 1958: 595; Perfil'ev, 1968: 142), and was considered to be a main vector of VL in Transcaucasia (Sergiev, 1979: 208).

Phlebotomus (*Larroussius*) *keshishiani* Shchurenkova

(Map 6)

Phlebotomus keshishiani Shchurenkova, 1936: 892 [♀ ♂]. Syntypes ♀ ♂, U.S.S.R. (TI, Dushanbe).
Phlebotomus (*Larroussius*) *keshishiani* Shchurenkova; Theodor & Mesghali, 1964: 291 [had probably often been confused with *major* and *wenyoni*]; Lewis, 1967: 19; 1978: 238; Perfil'ev, 1968: 274; Artemiev, 1978: 19.

♂ (*extra facts*, Pakistan, Said Pur, 6.vi.1965). Leg formula 100, 161, 113; 87, 181, 118; 108, 214, 141 (2·69, 1·09); tibia 3 = 2·65 mm long.

DISTRIBUTION. **Afghanistan**: Artemiev (1974: 157, map; 1978: 15). **Iran**: Nadim & Rashti (1978: 271, general map, 277); Nadim *et al.* (1977: 215). **Pakistan**: Lewis (1978*b*: 238, map). **U.S.S.R.**: Gaibov (1975*b*, Fergana area; 1976: 49, Surkhandar'ya); Perfil'ev (1968: 277); Petrishcheva (1935: 206).

NOTE. In the U.S.S.R. this species is numerous between 1900 and 2300 m (Perfil'ev, 1968: 277), and in Afghanistan ranges from 1000 to 2800 m and will bite man (Artemiev, 1978: 19).

Phlebotomus (*Larroussius*) *langeroni* Nitzulescu

(Map 7)

Phlebotomus perniciosus var.; Nitzulescu, 1930*c*: 382 [♂].
Phlebotomus langeroni Nitzulescu, 1930*e*: 548 [♂]. Holotype ♂, TUNISIA (FM, Paris?).
Phlebotomus (*Phlebotomus*) *langeroni* Nitzulescu; Parrot, 1940: 310.
Phlebotomus (*Larroussius*) *langeroni* Nitzulescu; Theodor, 1958: 24; Perfil'ev, 1968: 77; Croset, 1969: 311 [♀ apparently unknown]; Bailly-Choumara, Abonnenc & Pastre, 1971: 437; Rioux, Croset, Léger & Bailly-Choumara, 1974: 96; Croset, Rioux, Maistre & Bayar, 1978: 735.

DISTRIBUTION. **North Africa**: Croset (1969: 313, 316, maps, evidently very rare). **Tunisia**: Chadli *et al.* (1970: 358; 1970: 363; 1978: 733, map).

NOTE. The unknown female (Theodor, 1958: 24) is probably difficult to distinguish from *P. longicuspis* and *perniciosus*. The species seems to be rare in Tunisia (Croset *et al.*, 1978: 736).

Phlebotomus (*Larroussius*) *longicuspis* Nitzulescu

(Map 7)

Phlebotomus perniciosus var.; Nitzulescu, 1930*c*: 384 [in part, one ♂].
Phlebotomus langeroni var. *longicuspis* Nitzulescu, 1930*e*: 551 [♂]; Ristorcelli, 1941: 372. Syntypes ♂, TUNISIA (FM, Paris?).
Phlebotomus longicuspis Nitzulescu; Parrot, 1936: 138 [♀] [raised to species].
Phlebotomus (*Larroussius*) *longicuspis* Nitzulescu; Perfil'ev, 1968: 77; Croset, 1969: 312; Bailly-Choumara, Abonnenc & Pastre, 1971: 436; Rioux, Croset, Léger & Bailly-Choumara, 1974: 96; Croset, Rioux, Maistre & Bayar, 1978: 736.

Distribution. **North Africa**: Croset (1969: 321, 322, map). **Algeria**: Dedet (1979, map in *litt.*); Dedet *et al.* (1975: 185; 1977: 276). **Libya**: Ashford *et al.* (1977: 265, Bir Ayyad area, south of Surman). **Morocco**: Bailly-Choumara *et al.* (1971: 453); Rioux *et al.* (1974: 99). **Tunisia**: Chadli, Dancescu *et al.* (1970: 363); Chadli, Romain *et al.* (1970: 358); Croset *et al.* (1978: 737, map).

Note. This species has been found infected with *Le. d. infantum* in Algeria (Dedet, 1979: 58; Theodor, 1964: 480) and regarded as a VL vector in North Africa (Abonnenc, 1972: 34; Hoogstraal & Heyneman, 1969: 1185, 1186; Wilcocks & Manson-Bahr, 1972: 121) but in Tunisia seems too rare to be important (Croset *et al.*, 1978: 736).

Phlebotomus* (*Larroussius*) *longipes Parrot & Martin

(Map 7)

Phlebotomus (*Phlebotomus*) *longipes* Parrot & Martin, 1939: 143 [♀ ♂]; Kirk & Lewis, 1946*b*: 119; 1951: 434; Parrot, 1940: 316; 1953: 113 [papillae]; Minter, 1964: 209 [variation]; Abonnenc & Minter, 1965: 32; Abonnenc, 1972: 115. Syntypes 642 ♀, 896 ♂, Ethiopia (one ♀, labelled 'type' in Parrot's writing, in BMNH).

Phlebotomus longipes Parrot & Martin; Kirk & Lewis, 1947: 873; Abonnenc & Larivière, 1957: 399 [larva]; Ashford, 1974: 610; Gemetchu, 1974: 114.

Phlebotomus (*Larroussius*) *longipes* Parrot & Martin; Lewis, Mutinga & Ashford, 1972: 119.

♀ (*extra fact*, Ethiopia, Addis Ababa). Leg formula 100, 129, 81; 91, 148, 89; 102, 174, 108 (3·42, 1·26); tibia 3 = 2·19 mm. The length of the legs is evidently due to the size of the insect.

Distribution. **Africa**: Abonnenc (1972: 259, map). **Ethiopia**: Ashford (1974: 607). **Kenya**: Minter (1964: 209, map).

Note. This species transmits CL in Ethiopia (Ashford, 1977: 236; Schaller, 1972: 102; White, 1977: 163; Wilcocks & Manson-Bahr, 1972: 135).

Phlebotomus* (*Larroussius*) *major Annandale

Phlebotomus major Annandale, 1910: 46.

Phlebotomus (*Larroussius*) *major* Annandale; Perfil'ev, 1968: vii, 7, 49 [larva], 50, 54, 62, 75, 85, 253.

Some early records of *P. major* refer to other species described later. After their recognition Theodor & Mesghali (1964: 291) referred to *P. major*, generally found in mountainous country, as an eastern Mediterranean species occurring from Italy to north-west India where it was found mainly in the western Himalayas. Perfil'ev (1968: 94, 261) discussed its distribution and doubted the truth of Central Asian records.

Theodor (1958) recognized three subspecies, *major* in India, *neglectus* in Dalmatia and Italy, and *syriacus* in the Mediterranean and Caucasus. The following are records of *P. major* s. l.

Afghanistan: Artemiev (1978: 19). **Crete**: Hadjinicolaou (1958: 974); Hertig (1949*a*: 782, 787–789). **Greece**: Hadjinicolaou (1958: 968, 970, 972, 973); Hertig (1949*a*: 779, 781–786). **India**: Theodor (1958: 25). **Iran**: Nadim *et al.* (1977: 215; 1978: 26–28, maps; Chahar Mahal and other areas without details); Theodor & Mesghali (1964: 291, few at Hamadan, Kazerun and Yazd; some early records may refer to *P. tobbi*). **Italy**: Biocca *et al.* (1977*a*: 162, map; 1977*b*: 20, 28, map). Corradetti *et al.* (1956*a*: 6, map); Puccini *et al.* (1977: 38, map). **Rumania**: Duport *et al.* (1971: 394). **Turkey**: Yasarol (1980). **U.S.S.R.**: Petrishcheva (1937: 148). **Yugoslavia**: Simić & Živković (1956: 383–385, north and south Dalmatia, Hercegovina, Istra, Kosovo i Metohija, Makedonija, Montenegro, Serbia and Vojvodina).

Phlebotomus* (*Larroussius*) *major krimensis Perfil'ev

(Map 7)

Phlebotomus (*Larroussius*) *major krimensis* Perfil'ev, 1966: 282 [♀ ♂]; 1968: 226, 254, 256, 258, 259. Syntypes ♀ ♂, U.S.S.R. (ZI, Leningrad?).

? *Phlebotomus perniciosus* var. *tauricus* Nasonov, 1927: 369 [♀]. No type, U.S.S.R.: Crimea. Listed by Perfil'ev (1968: 253) under *P. major*. [Position doubtful.]

DISTRIBUTION. **U.S.S.R.**: Perfil'ev (1968: 255, 259, 261, Crimean subspecies).

NOTE. The names *tauricus* and *tauriae* (= *longiductus*) appear to have nothing to do with bulls or the Taurus Mountains but to be derived from Tauri, the name of an ancient Crimean tribe.

This form tends to remain in houses by day (Perfil'ev, 1968: 110) but not as much as *P. papatasi*.

Phlebotomus* (*Larroussius*) *major major Annandale

(Map 7)

Phlebotomus major Annandale, 1910: 46 [♂]; Summers, 1911: 110; Sinton, 1925: 107 [♀]; 1928: 303 [in part]. Lectotype ♀, INDIA (ZSI, Calcutta), designated by Quate, 1962*a*: 157.

[*Phlebotomus major* var. *perniciosus* Newstead [in part]; Brunetti, 1912: 201. Synonymized by Perfil'ev, 1968: 253.]

Phlebotomus (*Larroussius*) *major* Annandale; Theodor & Mesghali, 1964: 291; Perfil'ev, 1968: 253, 260 [in part].

Phlebotomus (*Larroussius*) *major major* Annandale; Lewis, 1978*b*: 238 [synonymy, including synonym *griseus* of which the type seems to be lost (Quate, 1962*a*: 157)].

DISTRIBUTION. **India, Nepal and Pakistan**: Lewis (1978*b*: 239).

Phlebotomus* (*Larroussius*) *major neglectus Tonnoir

(Map 7)

Phlebotomus neglectus Tonnoir, 1921*a*: 333. Syntypes 12 ♀, 3 ♂, ALBANIA, YUGOSLAVIA, ITALY (NM, Vienna).

Phlebotomus (*Larroussius*) *major neglectus* Tonnoir; Theodor, 1958: 25; Perfil'ev, 1968: 254.

DISTRIBUTION. **Albania, Italy & Yugoslavia**: Tonnoir (1921: 333). **Italy & Dalmatia**: Theodor (1958: 25).

NOTE. *P. major* is considered to be a vector of VL in the western Mediterranean (Theodor, 1964: 480) and Yugoslavia (Lupascu *et al.*, 1977: 192).

Phlebotomus* (*Larroussius*) *major syriacus Adler & Theodor

(Map 7)

Phlebotomus major Annandale [in part]; Adler & Theodor, 1929: 275 [♀ ♂]; Adler, 1946: 501; Cristescu & Dancescu, 1967: 320; Rioux & Golvan, 1969: 93; Rioux, Croset, Léger & Bailly-Choumara, 1974: 96.

Phlebotomus major var. *syriacus* Adler & Theodor, 1931: 467; Adler, 1946: 500 [♀]. Type(s), PALESTINE, SYRIA (depository unknown).

Phlebotomus (*Larroussius*) *major syriacus* Adler & Theodor; Theodor, 1958: 25 [♂]; Perfil'ev, 1968: 254; Houin, Abonnenc & Deniau, 1971: 644; Léger *et al.*, 1974: 20.

Phlebotomus (*Larroussius*) *major* Annandale [in part]; Biocca, Coluzzi & Constantini, 1977*a*: 160–162.

DISTRIBUTION. **Mediterranean, Caucasus, Crete, Crimea, Greece, Israel and Syria**: Theodor (1958: 25). **Greece**: Léger *et al.* (1979: 17). **Jordan**: Perfil'ev (1968: 255). **Turkey**: Houin *et al.* (1971: 644). **U.S.S.R.**: Izmail and Transcaucasia probably, Perfil'ev (1968: 255).

NOTE. In Greece, as in the Cévennes, Corsica and Serbia, *P. major* is abundant only above 300 m (Léger *et al.*, 1979: 20). It is evidently a good vector of VL (Molyneux, 1977: 48) and is a vector in the eastern Mediterranean area (Hoogstraal & Heyneman, 1969: 1185; Theodor, 1964: 480; Wilcocks & Manson-Bahr, 1972: 121). It is a main vector in Crete (Léger *et al.*, 1979: 20) and Greece (Adler, 1964: 80; Lupascu *et al.*, 1977: 192; Perfil'ev, 1968: 142), and may transmit VL in southern Italy and Sicily (Biocca *et al.*, 1977*a*: 165).

Phlebotomus* (*Larroussius*) *major wui Yang & Xiong

(Map 7, type area)

[*Phlebotomus major* Annandale; Ding & He, 1962: 388. Misidentification.]

Phlebotomus major wui Yang & Xiong, 1965: 412 [♀ ♂]. Syntypes ♀ ♂, CHINA: north and south Xinjiang (Institute of Parasitic Diseases, Chinese Academy of Medical Sciences, Shanghai).

Distribution. **China**: Artux, Dunhuang, Ha-mi, Kashi, Tacheng and Yning (Yang & Xiong, 1965); desert areas of Xinjiang and of Ejina County in Inner Mongolia (Wu *et al.*, 1979).

Note. This is probably *P. smirnovi* according to Professor Leng Y.-j. (1981, pers. comm.), and is a desert zoophilic form in south Xinjiang (Xiong *et al.*, 1970). The following are among features reported by Wu *et al.* (1979). In Xinjiang the form occurs from early May to late September, with population peaks in June and August; in the Karamay Desert it rests in gerbil burrows, and in the Tarim Basin attacks people near villages and is attracted to light. In Inner Mongolia the form occurs from early June to late August and has one peak in July.

Phlebotomus* (*Larroussius*) *mariae Rioux, Croset, Léger & Bailly-Choumara

(Map 7)

Phlebotomus (*Larroussius*) *mariae* Rioux, Croset, Léger & Bailly-Choumara, 1974: 92 [♂]. Syntypes 6 ♂, Morocco (EM, Montpellier).

Phlebotomus* (*Larroussius*) *mascittii Grassi

Phlebotomus mascittii Grassi, 1908: 681.
Phlebotomus (*Adlerius*) *mascittii* Grassi; Perfil'ev, 1968: 8, 16.

Phlebotomus* (*Larroussius*) *mascittii canaaniticus Adler & Theodor

(Map 8)

Phlebotus Adler & Theodor, 1931*b*: 468 [♀ ♂]. Syntypes 2 ♀, 4 ♂, Israel (BMNH).
Phlebotomus larroussei var. *canaaniticus* Adler & Theodor; Adler, Theodor & Witenberg, 1938: 501.
Phlebotomus (*Larroussius*) *mascittii canaaniticus* Adler & Theodor; Theodor, 1958: 31; Perfil'ev, 1968: 95.

Distribution. **General**: Perfil'ev (1968: 95, east of typical subspecies, in Israel, Jordan and Syria). **Israel**: Adler & Theodor (1931*b*: 471, Ben Shemen, Rosh Pinna, Tel Aviv); Adler & Witenberg (1938: 500, Jerusalem area).

Phlebotomus* (*Larroussius*) *mascittii mascittii Grassi

(Map 8)

Phlebotomus mascittii Grassi, 1908: 681 [♀ ♂]; Newstead, 1914: 182; Sinton, 1928: 310; Adler & Theodor, 1931*a*: 106; Hertig, 1950: 453 [discussion]; Raynal, 1954: 306; Guevara-Benîtez, Ubeda Ontiveros & Morillas Marquez, 1978: 832. Lectotype ♂, Italy (BMNH), designated by Hertig, 1950: 457 [examined].
Phlebotomus larroussei Langeron & Nitzulescu, 1931: 73; Raynal & Le Gac, 1932: 504; Adler, Theodor & Witenberg, 1938: 498; Hertig, 1950: 455 [probably *mascittii*]. Syntypes ♀, France (depository unknown). [Synonymized by Saccà, 1948*a*: 226; Raynal, 1954: 307.]
Phlebotomus vesuvianus Adler & Theodor, 1931: 108. Syntypes 13 ♀, Italy (BMNH). [Synonymized by Raynal, 1954: 307; Theodor, 1958: 29.]
Phlebotomus perniciosus var. *nitzulescui* Simić, 1932: 432. Syntypes 3 ♂, Yugoslavia (depository unknown). [Synonymized by Raynal, 1954: 307; Theodor, 1958: 29.]
Phlebotomus (*Phlebotomus*) *larroussei* Langeron & Nitzulescu; Parrot, 1941: 45.
Phlebotomus (*Adlerius*) *larroussei* Langeron & Nitzulescu; Theodor, 1948: 108.
Phlebotomus (*Adlerius*) *mascittii mascittii* Grassi; Saccà, 1949*b*: 552; Theodor, 1958: 29; Croset, 1969: 300; Houin, Abonnenc & Deniau, 1971: 642.
Phlebotomus (*Adlerius*) *mascittii* Grassi; Perfil'ev, 1968: 16 [discussion], 95; Rioux & Golvan, 1969: 27, 51, 73; Croset, 1969: 300; Houin, Abonnenc & Deniau, 1971: 642; Biocca, Coluzzi & Constantini, 1977*b*: 31.
Phlebotomus mascittii Grassi; Artemiev, 1980: 1181 [male fits *Larroussius*], 1185.

♀. Leg formula (after Raynal & Le Gac, 1932) 100, 135, 83; 135, 158, 89; 114, 187, 109 (0·86).

Distribution. **General**: Perfil'ev (1968: 95, western Europe as far east as Greece); Theodor (1958: 31, Corsica, Crete, Cyprus, France, Italy and Yugoslavia). **Europe**: Croset (1969: 305, map). **Crete**: Elounda, 35°16′N, 25°42′E (13.v.1979, *D. M. A.*, biting man indoors). **Cyprus**: Adler (1946: 503). **France**: Colas-Belcour & Rageau (1956, map); Croset (1969: 303, map); Houin *et al.* (1977: 113, map, 114); Rioux &

Golvan (1969: 75, 76, map, Calvados, Savignies etc.). **Italy**: Corradetti *et al.* (1956*a*: 6, map); Biocca *et al.* (1977*a*: 160, map; 1977*b*: 20, rare, 29, map); Maroli & Bettini (1977: 318); Puccini *et al.* (1977: 38, map). **Switzerland**: Gaschen (1956*a*: 225; 1956*b*: 228); Perfil'ev (1968: 16). **Turkey**: Houin *et al.* (1971: 642).

NOTE. *P. mascittii* is here placed provisionally in *Larroussius.*

Professor J. A. Rioux (1979, in *litt.*) told me the history of the Calvados (France) record, one of the most northerly for a sandfly, which was recounted to him by the late J. Colas Belcour. 'Dans sa proprietée de Normandie [at Condé-sur-Ife, 49°03'N, 0°07'W] séjournait à cette époque, Mme Colas Belcour. En plain jour, elle est attaquée par un Phlébotome. Elle a le réflexe de couvrir l'insecte avec un verre à boire et donc de le capturer vivant. Elle alerte immédiatement son mari qui travaillait à l'Institut Pasteur, dans de service de M. Roubaud. Colas Belcour récoupère le Phlébotome, l'identifie et le publie avec son épouse [Colas Belcour & Colas Belcour, 1929] comme *Phlebotomus perniciosus*'. Langeron & Nitzulescu (1932: 293) thought it was probably *P. larroussei* (= *mascittii*), and Colas Belcour & Tisseuil (1936: 121, footnote) and Raynal (1954: 309) agreed.

Savignies is 49°28'N, 01°58'E, and Rioux & Golvan (1969: 75) remarked that the species doubtless existed in Belgium, Germany and Luxembourg.

This species bites man but its ecology is little known (Croset, 1969: 309).

***Phlebotomus* (*Larroussius*) *orientalis* Parrot**

(Map 8)

Phlebotomus (*Phlebotomus*) *langeroni* var. *orientalis* Parrot, 1936: 30 [♀ ♂]; Kirk & Lewis, 1946*a*: 39; 1946*b*: 120; 1948: 326; 1955: 235. Syntypes 24 ♀, 32 ♂, ETHIOPIA (IP, Algiers).

[*Phlebotomus perniciosus* Newstead; Archibald & Mansour, 1937: 395; Sinton, 1937: 404; Kirk, 1939: 541. Misidentifications according to Kirk & Lewis, 1940: 627.]

[*Phlebotomus langeroni* Nitzulescu; Theodor, 1938: 165. Misidentification according to Kirk & Lewis, 1940: 627.]

Phlebotomus (*Phlebotomus*) *orientalis* Parrot; Parrot & Clastrier, 1946: 64; Kirk & Lewis, 1951: 432; 1952: 340; Heisch & Guggisberg, 1952: 427; Parrot, 1953: 113; Abonnenc, Dyemkouma & Hamon, 1964: 160; Abonnenc & Minter, 1965: 72; Hoogstraal & Heyneman, 1969: 1156; Abonnenc, 1972: 118.

Phlebotomus (*Larroussius*) *langeroni orientalis* Parrot; Theodor, 1958: 24; Qutubuddin, 1962: 597; Lewis & Hitchcock, 1968: 118; Perfil'ev, 1968: 92; Lewis, Minter & Ashford, 1974: 440.

Phlebotomus (*Phlebotomus*) *langeroni orientalis* Parrot; Quate, 1964: 238.

Phlebotomus orientalis Parrot; Davis, 1967: 52; Ashford, 1974: 610; Hoogstraal & Heyneman, 1969: 1156 [synonymy].

DISTRIBUTION. **Africa**: Abonnenc (1972: 259). **Ethiopia**: Ashford (1974: 608; 1977: 236, wide altitude range); Diredawa (1936, *C. A. V. B.*); Fuller *et al.* (1979: 419, map); Gemetchu & Fuller (1976: 82); Gemetchu *et al.* (1975: 45; 1977: 209). **Kenya**: Minter (1964: 207); Wajir (1943, *J. P. M.*). **Saudi Arabia**: Lewis & Büttiker, 1980: 263). **Southern Yemen**: 'Wadi Ayaraq' (1962, *S. A. S.*); Whittingham (1937, as *P. perniciosus*). **Sudan**: Hoogstraal & Heyneman (1969: 1155). **Yemen**: Büttiker & Lewis (1979: 370); Hoogstraal & Heyneman (1969: 1157); Lewis (1974*b*: 188).

NOTE. In the Sudan and Ethiopia this species occurs in *Acacia seyal-Balanites* forest which is associated with deeply cracking dark clay soils (Fuller *et al.*, 1979: 429). It was suspected of being the vector of VL in the Sudan by Kirk & Lewis (Adler, 1964: 78, 90) and shown to be so by the extensive work of Hoogstraal & Heyneman (1969: 1185, 1186, 1194) (Abonnenc, 1972: 34, 120; Wilcocks & Manson-Bahr, 1972: 122; Williams & Coelho, 1978: 17). It may transmit the disease in Ethiopia (Ashford *et al.*, 1973: 263; Fuller *et al.*, 1979: 429; Gemetchu *et al.*, 1977: 209; White, 1977: 163).

***Phlebotomus* (*Larroussius*) *pedifer* Lewis, Mutinga & Ashford**

(Map 8)

Phlebotomus (*Larroussius*) *pedifer* Lewis, Mutinga & Ashford, 1972: 12 [♀ ♂]; Mutinga, 1975: 347. Holotype ♂, KENYA (BMNH) [examined].

Phlebotomus pedifer Lewis, Mutinga & Ashford; Ashford, 1974: 610.

DISTRIBUTION. **Ethiopia**: Ashford (1974: 610, Boleta Forest, Ochollo); Lewis *et al.* (1972: 132, Shabe, 7°31′N, 36°30′E). **Kenya**: Lewis *et al.* (1972: 132, Mount Elgon area). **Sudan**: Lewis *et al.* (1972: 132, Gilo and Katire).

NOTE. *P. pedifer* bites man readily out of doors in the Mount Elgon area and transmits CL (Mutinga, 1975: 346) and is a vector of CL in Ethiopia (Ashford, 1977: 236; Bray, 1974: 92; Peters *et al.*, 1977: 502; White, 1977: 163).

Phlebotomus (Larroussius) perfiliewi Parrot

Phlebotomus perfiliewi Parrot, 1930: 383; Corradetti, Saccà & Neri, 1956*b*: 105; 1957: 226.
Phlebotomus (*Larroussius*) *perfiliewi* Parrot; Perfil'ev, 1968: 48 [larva], 50, 62, 75, 76, 83.

Phlebotomus (Larroussius) perfiliewi galilaeus Theodor

(Map 8)

Phlebotomus (*Larroussius*) *perfiliewi galilaeus* Theodor, 1958: 26 [♂; distinction from subsp. *transcaucasicus* uncertain]; Theodor & Mesghali, 1964: 292; Perfil'ev, 1968: 267. Syntypes ♂, CYPRUS, ISRAEL (BMNH).

DISTRIBUTION. **Cyprus and Israel**: Theodor (1958: 26). **Cyprus**: Liopetri, Panagera, 33°04′N, 35°20′E, Salamis, Sotira area (x.1971, *J. P. T. B.*). **Turkey**: Yasarol (1980).

Phlebotomus (Larroussius) perfiliewi perfiliewi Parrot

(Map 8)

Phlebotomus perfiliewi Parrot, 1930: 383 [♂]; Hertig, 1949*b*: 286; Saccá, 1950: 681 [early stages]; Corradetti, Saccà & Neri, 1956*b*: 105 [figures in pl. 2 transposed]; 1957: 226; Corradetti, Neri, Verolimi, Palmieri & Proietti, 1961: 102. Syntypes 4♂, U.S.S.R. (IP, Algiers?).
Phlebotomus macedonicus Adler & Theodor, 1931: 468 [♀ ♂]. Syntypes 4 ♀, 19 ♂, GREECE (BMNH). [Synonymized by Adler, 1946: 500.]
Phlebotomus perniciosus var.; Simić, 1932: 432. [Synonymized by Simić & Živković, 1956: 384.]
Phlebotomus sp. n.; Simić & Živković, 1947: 195. [Synonymized by Simić & Živković, 1956: 384.]
Phlebotomus (*Larroussius*) *perfiliewi perfiliewi* Parrot; Theodor, 1958: 25; Perfil'ev, 1968: 263.
Phlebotomus (*Larroussius*) *perfiliewi* Parrot; Perfil'ev, 1968: 263 etc.; Croset, 1969: 327; Biocca, Coluzzi & Constantini, 1977*a*: 160–162; 1977*b*: 30; Rioux, Croset, Léger & Rosin, 1977: 378; Croset, Rioux, Maistre & Bayar, 1978: 738.

DISTRIBUTION. **Balkans, Italy, Malta, north-west Africa and U.S.S.R. (Crimea)**: Dolmatova (1962: 459); Theodor (1958: 26). **Mediterranean area**: Croset (1969: 333, map); Dedet *et al.* (1977: 256); Rioux *et al.* (1977: 379, map). **Algeria**: Dedet (1979, map in *litt.*). **Greece**: Hadjinicolaou (1958: 968); Léger *et al.* (1979: 20); Macedonia (viii.1918, *J. W.*). **Italy**: Biocca *et al.* (1977*a*: 161, map; 1977*b*: 28, map); Hertig (1949*a*: 796, 797); Maroli & Bettini (1977: 318). **Morocco**: Rioux *et al.* (1977: 377). **Rumania**: Duport *et al.* (1971). **Sardinia**: Hertig (1949*a*: 798). **Tunisia**: Chadli, Dancescu *et al.* (1970: 361); Chadli, Romain *et al.* (1970: 358); Croset (1969: 331, map); Croset *et al.* (1978: 737, map); Dedet (1971: 157). **Turkey**: Yasarol (1980). **U.S.S.R.**: Parrot (1930: 383); Perfil'ev (1968: 266, Moldavia, north-east Caucasus). **Yugoslavia**: Simić & Živković (1956: 383–385, Kosovo i Metohija, Makedonija, Serbia, Sibenik, Split and Vojvodina).

NOTE. *P. perfiliewi* is a main vector of *Le. donovani* in Greece (Perfil'ev, 1968: 142), transmits VL in Serbia and possibly Greece, and canine leishmaniasis in Tunisia (Léger *et al.*, 1979: 20). It may have transmitted VL in Emilia-Romagna in 1971 under unusual weather conditions (Killick-Kendrick *et al.* (1977: 169, 173), and is probably a vector of VL in Rumania (Adler, 1964: 79). Its secondary role in canine kala-azar in Tunisia is discussed by Maroli & Bettini (1977: 320), and its relation to VL in Yugoslavia by them and Lupascu *et al.* (1977: 192).

This species transmits CL in Italy (Biocca *et al.*, 1977*b*: 20; Corradetti, 1977: 194; Rivosecchi *et al.*, 1977: 135), is a possible vector in Italy (Killick-Kendrick *et al.*, 1977: 169, 170, 173; Lupascu *et al.*, 1977: 192), and is the probable vector in the Abruzzi (Croset *et al.*, 1978: 739). It is strongly suspected of transmitting CL in part of Grosseto Province of Italy and of being the vector in the Abruzzi and Emilia-Romagna (Maroli & Bettini, 1977: 315, 320).

Phlebotomus* (*Larroussius*) *perfiliewi transcaucasicus Perfil'ev

(Map 8)

Phlebotomus transcaucasicus Perfil'ev, 1937: 108 [♂]. Type(s), U.S.S.R.: Transcaucasia, Divichi (near Baku) and Nakhichevan (ZI, Leningrad?).

Phlebotomus (*Larroussius*) *perfiliewi transcaucasicus* Perfil'ev; Theodor, 1958: 26 [status undecided, possibly a synonym of *galilaeus*]; Theodor & Mesghali, 1964: 291; Perfil'ev, 1968: 267 [♀]; Ahmad, 1976: 43, 152, 156.

Distribution. **Iran**: Theodor & Mesghali (1964: 292, one at Kazvin). **Iraq**: Ahmad (1976: 99). **U.S.S.R.**: Perfil'ev (1968: 267) and Theodor & Mesghali (1964, Azerbaydzhan, Baku, Nakhichevan, north-east Caucasus and Transcaucasia); Dzhavadov *et al.* (1978: 143, Astanly, Dzhalilabad, Kanaga and Tazakent).

Note. This form appears to be a vector of *Le. donovani* in Azerbaydzhan (Perfil'ev, 1968: 142).

Phlebotomus* (*Larroussius*) *perniciosus Newstead

(Map 9)

Phlebotomus nigerrimus Newstead, 1911*a*: 68 [♀]; Summers, 1913: 106; Perfil'ev, 1968: 9, 253. Syntypes 2 ♀, Malta. [Synonymized with *P. perniciosus* by Raynal, 1954: 301.]

Phlebotomus perniciosus Newstead, 1911*a*: 70 [♀ ♂]; Gaschen, 1945: 140 [♀ ♂]; 1956: 226; Hertig, 1950: 453; Saccà, 1950: 684 [early stages]; Raynal, 1954: 306; Corradetti, Saccà & Neri, 1956*b*: 105; 1957: 226; Abonnenc & Larivière, 1957: 401 [larva]; Guevara-Benîtez, Ubeda-Ontiveros & Morillas-Marquez, 1978: 821, 831. Syntypes ♀ ♂, Malta (depository unknown).

Phlebotomus legeri Mansion, 1913: 639; 1914: 588. Syntypes ♀ ♂, Corsica (L, Bastia?; Mansion, 1914: 590). [Synonymized by Larrousse, 1921: 40; Raynal, 1954: 301; Perfil'ev, 1968: 16; Theodor, 1958: 26.]

Phlebotomus perniciosus var. *nigerrimus* Newstead [?]; Newstead, 1914: 184; Perfil'ev, 1968: 9, 161, 253. [Synonymized by Larrousse, 1921: 40; Raynal, 1954: 301; Perfil'ev, 1968: 16.]

Phlebotomus lusitanicus França, 1918: 732. Type(s), Portugal (MB, Colares?; França, 1918: 731; 1922: 9, 18). [Synonymized by Larrousse, 1921: 37; Raynal, 1954: 301.]

Phlebotomus grassii Pierantoni, 1925: 5. Type(s), Italy: near Naples (MZ, Turin?; Pierantoni, 1925: 1, 8). [Synonymized by Adler & Theodor, 1931*a*: 106.]

Phlebotomus major Annandale var. *perniciosus* Newstead; Sinton, 1928: 303.

Phlebotomus (*Larroussius*) *perniciosus* Newstead; Theodor, 1948: 107; 1958: 26; Saccà, 1949*b*: 552; Nicoli, 1956: 112 [hairs]; Perfil'ev, 1968: 9; Rioux & Golvan, 1969: 25, 78; Croset, 1969: 397; Rioux, Croset, Léger & Bailly-Choumara, 1974: 96; Biocca, Coluzzi & Constantini, 1977*a*: 162; 1977*b*: 30; Croset, Rioux, Maistre & Bayar, 1978: 740.

Phlebotomus perniciosus legeri Mansion; Nicoli, 1955: 33; 1956: 110 [hairs].

♀. Leg formula, Spain, after Zariquiey, 1937: 411, 100, 110, 66; 101, 133, 77; 117, 177, 101 (0·78)(♀ & ♂ by Toumanoff & Chassignet, 1954: 680).

Distribution. **Western Europe and Africa**: Croset (1969: 407). **Algeria**: Dedet (1979, map *in litt.*); Dedet & Addadi (1977: 86); Dedet *et al.* (1977: 254, map). **France**: Colas-Belcour (1958: 826, map); Colas-Belcour & Rageau (1956, map); Croset (1969: 403, map); Houin *et al.* (1977: 113, map, 114); Rioux & Golvan (1969: 51, 83, map). **Italy**: Biocca *et al.* (1977*a*: 161, map; 1977*b*: 20, common and widespread, 28, map); Corradetti *et al.* (1956*a*: 6, map); Maroli & Bettini (1977: 318); Puccini *et al.* (1977: 38, map). **Jersey**: [?] Marett (1923*a*; 1923*b*, St. Helier which is 49°12′N). **Libya**: Ashford *et al.* (1977: 265). **Morocco**: Bailly-Choumara *et al.* (1971: 453). **Portugal**: Azavedo (1954: 247); França (1918: 731). **Sardinia**: Hertig (1949*a*: 798). **Spain**: 'Fulgencio' and 'Jalavara' (1931, through *J. A. S.*); Gil Collado (1977: 186); Najera (1937: 1488); Zariquiey (1944: 18). **Switzerland**: Gaschen (1956*b*: 228). **Tunisia**: Chadli, Dancescu *et al.* (1970: 363); Chadli, Romain *et al.* (1970: 358); Croset (1969: 405); Croset *et al.* (1978: 737, map); Dedet (1971: 157). **Turkey**: Yasarol (1980). **Yugoslavia**: Simić & Živković 1956: 383–385, north Dalmatia and Istra).

Note. '*P. nigerrimus*' was described from females, and Newstead (1911*a*) hoped that P. J. Marret would find males. Newstead (1914) examined some and considered them a dark variant of *perniciosus*, but a male labelled 'Malta. 1910. Capt. Marett. *Phlebotomus perniciosus* var. *nigerrimus*, Newst. Type ♂. Pres. R. Newstead B. M. 1947–141.' is *P. perfiliewi*. It seems likely that the original *nigerrimus* were *perniciosus*, but could be confused with dark forms of at least one other species.

The name *nigerrimus* has page preference over *perniciosus* but became a junior synonym of it following the action of Raynal, the first reviser (ICZN, 1964: Article 24 (a)).

In Jersey on 1 September 1923 Marett (1923*a*, *b*) was surprised to find a phlebotomine and wrote to the press as follows. 'Sir—I have the honour to request you to insert this letter in your paper. On the night of the 1st instant, I captured a Phlebotomus fly, and should be glad to know if any scientist may be breeding the fly in the Island. I have the honour to be, Sir, Your obedient servant, P. Jauvin Marett Lt. Col., M.O.H., States, Jersey. Royal Square 2/9/23.' The fly, a male, was identified by Newstead as *P. perniciosus*, but, in view of Hertig's (1953: 453) remarks on the aedeagus, it may conceivably have been *P. mascittii*. Dr W. J. Le Quesne (1970, 1971, *in litt.*) told me of the letter and informed me that Marett lived successively in two houses on the outskirts of St Helier. Le Quesne and other entomologists have sought this species without result. It may have been in Jersey since the island was attached to the mainland (Ragge, 1965: 256) and have disappeared with housing developments. It probably exists at the same latitude in France (Rioux & Golvan, 1969: 83).

P. perniciosus bites man indoors in Tunisia where its two annual peaks correspond with the transmission periods of VL (Croset *et al.*, 1978: 741, 743). It has been readily infected with the parasites of VL (Molyneux, 1977: 48) and is a vector in the western Mediterranean basin (Hoogstraal & Heyneman, 1969: 1185, 1186; Wilcocks & Manson-Bahr, 1972: 121), the main vector in north Africa (Dedet, 1976: 422; Perfil'ev, 1968: 142; Theodor, 1964: 480), and very probably the habitual vector in Tunisia (Croset *et al.*, 1978: 744). It transmits canine leishmaniasis near Tours in France (Houin *et al.*, 1977: 114), is probably the main vector of VL in Provence (Ranque *et al.*, 1977: 286, 292), has been proved to be the vector of VL in southern Italy (Biocca *et al.*, 1977*b*; Rivosecchi, 1977: 135), Sicily and Malta (Biocca *et al.*, 1977*a*: 165), and is probably the vector of VL in the Monte Argentario area of the Italian Province of Grosseto (Maroli & Bettini, 1977: 315, 320). Its relation to VL in general was discussed by Saf'yanova (1967: 36) and in Italy by Killick-Kendrick *et al.* (1977: 170, 173). It has been found to harbour a sandfly fever virus in Italy (Rivosecchi, 1977: 136).

Phlebotomus* (*Larroussius*) *smirnovi Perfil'ev

(Map 9)

Phlebotomus smirnovi Perfil'ev, 1941: 279 [♀ ♂]; Shakirzyanova, 1950: 26. Syntypes ♀, ♂, U.S.S.R. (ZI, Leningrad?).

Phlebotomus (*Larroussius*) *smirnovi* Perfil'ev; Theodor, 1958: 27; Perfil'ev, 1968: 277.

DISTRIBUTION. **U.S.S.R.**: Dergacheva *et al.* (1978, Kzyl-Orda area); Perfil'ev (1968: 95, 279, 281, Osh area in Kirgiziya).

NOTE. *P. smirnovi* probably transmits VL in the Kzyl-Orda region (Dergacheva *et al.*, 1978).

Phlebotomus* (*Larroussius*) *somaliensis Abonnenc, Adam & Bailly-Choumara

(Map 9)

Phlebotomus somaliensis Abonnenc, Adam & Bailly-Choumara, 1959: 588 [♀]; Abonnenc & Minter, 1965: 38; Abonnenc, 1972: 120. Holotype ♀, SOMALI REPUBLIC: cave at 'Shamah Aleh' near the Asseh Hills (IP, Algiers).

Phlebotomus* (*Larroussius*) *tobbi Adler & Theodor

(Map 9)

Phlebotomus perniciosus var. *tobbi* Adler & Theodor *in* Adler, Theodor & Lourie, 1930: 536 [♀ ♂]; Nitzulescu, 1931*b*: 267. Syntypes 27 ♀, 40 ♂, IRAN; ISRAEL (BMNH).

Phlebotomus tobbi Adler & Theodor; Parrot, 1934: 80.

Phlebotomus pirumovi Burakova & Mirzayan, 1934: 89 [short description in a footnote & reference to full description which was apparently not published]; Perfil'ev, 1968: 271, 273. Type(s), U.S.S.R. (ZI, Leningrad?). [Synonymized by Perfil'ev, 1941: 273, 281.]

Phlebotomus perniciosus Newstead [in part]; Adler & Theodor, 1957: 215 [proboscis].

Phlebotomus (*Larroussius*) *perniciosus tobbi* Adler & Theodor; Theodor, 1958: 27; Rioux & Golvan, 1969: 81, 82; Ahmad, 1976: 43, 144; Guevara-Benîtez, Ubeda-Ontiveros & Morillas-Marquez, 1978: 832.

Phlebotomus (*Larroussius*) *tobbi* Adler & Theodor; Perfil'ev, 1968: 271; Croset, 1969: 341; Houin *et al.*, 1971: 635.

DISTRIBUTION. **Eastern Mediterranean area**: Perfil'ev (1968: 273, Cyprus, Greece, Israel, Jordan and Syria); Theodor & Mesghali (1964: 292, widely distributed from Yugoslavia to north-west Iran). **Europe and North Africa**: Croset (1969: 342, probably not in western Europe; 1967: 177, Tunisian records probably refer to *P. longicuspis* or *P. perfiliewi*); Dolmatova (1962: 460, map, evidently including *P. perniciosus*); Houin (1977: 167, not west of Yugoslavia; old records from France and Spain must refer to *P. perniciosus*). **Albania**: Perfil'ev (1968: 8, possibly *P. perniciosus*). **Greece**: Hadjinicolaou (1958: 968, 972); Hertig (1949*a*: 779, 781–783); 'Kerken', Struma Valley (26.vi.1935, *P. A. B.*); Léger *et al.* (1979: 17). **Iran**: Adler *et al.* (1930: 537, Resht); Lewis *et al.* (1961: 206); Nadim & Rashti (1978: 27, areas indicated); Nadim *et al.* (1977: 215); Theodor & Mesghali (1964: 291, 292, in north-west; probably some early records refer to *P. major*). **Iraq**: Ahmad (1976: 99). **Israel**: Adler *et al.* (1930: 537, Ajaleth, Rosh Pinna); Pazael (7.v.1979, *Y. S.*). **Lebanon**: Mechref (1964, *L. E. S.*). **Sicily**: Catania (♂ presented to BMNH in 1931 by *S. A.* as *P. perniciosus*; 'var. *tobbi*' added in Theodor's writing). **Turkey**: Houin *et al.* (1971: 635). **U.S.S.R.**: Dzhavadov *et al.* (1978: 143, Astanty, Dzhalilabad and Tazakent); Perfil'ev (1968: 273, Armenia, Azerbaydzhan and Gruziya; absent from Turkestan); Theodor & Mesghali (1964: 292). **Yugoslavia**: Nitzulescu (1931*b*: 267, Skoplje); Simić & Živković (1956: 383–385, north and south Dalmatia, Hercegovinia, Istra, Kosovo i Metohija, Makedonija, Montenegro and Serbia).

NOTE. *P. tobbi* is a vector of VL in the eastern Mediterranean area and probably in Transcaucasia (Theodor, 1964: 480, 485) and is probably a vector in Azerbaydzhan (Perfil'ev, 1968: 142) and Cyprus (Adler, 1946: 510). It is too rare to be significant in Greece(Léger *et al.*, 1979: 23).

Phlebotomus* (*Larroussius*) *wenyoni Adler & Theodor

(Map 9)

Phlebotomus wenyoni Adler & Theodor *in* Adler, Theodor & Lourie, 1930: 353 [♀ ♂]. Syntypes 25 ♀, 53 ♂, IRAN (BMNH).

Phlebotomus (*Larroussius*) *wenyoni* Adler & Theodor; Theodor, 1958: 27; Theodor & Mesghali, 1964: 291; Ahmad, 1976: 49, 162.

DISTRIBUTION. **General**: Theodor & Mesghali (1964: 292, apparently very restricted). **Iran**: Nadim *et al.* (1978: 27, Chahar Mahal and other areas); Theodor & Mesghali (1964: 292, Hamadan, Kermanshah, Malayer and Tehran; seemed restricted to north-west). **Iraq**: Ahmad (1976: 99); Theodor & Mesghali (1964: 292, Salahuddin). **Turkey**: Yasarol (1980). **U.S.S.R.**: Perfil'ev (1968: 270, Ashkabad and Karakala areas in Turkmeniya); Petrishcheva (1935: 20).

According to Theodor & Mesghali (1964) some old records may refer to *P. keshishiani* or *P. major*.

Subgenus *ADLERIUS* Nitzulescu

Phlebotomus subgenus *Adlerius* Nitzulescu, 1931: 271; Theodor, 1948: 98; 1958: 27; Theodor & Mesghali, 1964: 292; Perfil'ev, 1968: 73, 81, 280 [also vii, 8, 48 (larva), 51, 60 (egg), 75, 77, 280 on *P. chinensis* s. l.]; Lewis, 1978*b*: 239; Artemiev, 1978: 19, 20, 75; 1980: 1171, 1180. Type-species: *Phlebotomus chinensis* Newstead, 1926, by original designation.

Professor Leng Yan-jia informed me in 1980 that several taxa in China await study, therefore most '*P. chinensis*' in Map 10 are marked with a query.

Key to the species of subgenus *Adlerius* (after Artemiev, 1980).

Females

Artemiev recommends that males should be identified first, and accompanying females compared with data in his table. Some characters are indefinite, and descriptions should be consulted.

Males

1	Two ascoids on antennal segments 3–15	2
–	One ascoid on antennal segments 9–15	3
2	Subterminal tubercle of aedeagus far (30–35 μm) from tip	***chinensis*** (p. 165)
–	Subterminal tubercle of aedeagus near (6–8 μm) tip	***simici*** (p. 168)
3	Antenna 8 with two ascoids	4
–	Antenna 8 with one ascoid	11
4	Coxite with 14–27 hairs in group, rarely 29	5
–	Coxite with 29–115 hairs in group, rarely 27	6
5	Whole hair-group on basal half of coxite. Tubercle of aedeagus 6–16 μm from tip	***turanicus*** (p. 168)
–	Part of hair-group on distal half of coxite. Tubercle of aedeagus 19–28 μm from tip	***brevis*** (p. 165)
6	All 69–114 hairs of group on basal half of coxite; coxite wide	***rupester*** (p. 167)
–	Some of 27–85 hairs of group on distal half of coxite	7
7	Aedeagus with rectangular subterminal notch	***halepensis*** (p. 166)
–	Aedeagus with normal obtuse-angled subterminal notch	8
8	Coxite with 27–50 group-hairs. Sandfly dark	***kabulensis*** (p. 167)
–	Coxite with 50–85 group-hairs. Sandfly of normal colour or pale	9
9	Sperm tubes long (1200–1700 μm)	***longiductus*** (p. 167)
–	Sperm tubes of average length (900–1100 μm)	10
10	Coxite with 50–60 group-hairs. Sandfly large (antenna 3 = 400–430 μm)	***arabicus*** (p. 164)
–	Coxite with 65–75 group-hairs. Sandfly of normal size (antenna 3 = 340–375 μm). Iran	'Sp. 1' of doubtful status (related to *arabicus*)
11	Antenna 6 and 7 with two ascoids of same length	12
–	Antenna 6 and 7 with one ascoid or with one long and one short	14
12	Coxite with 35–60 group-hairs. Sperm tubes 740–1000 μm long. Sandfly small	***davidi*** (p. 166)
–	Coxite with 69–110 group-hairs	13
13	Coxite with 69–94 group-hairs	***hindustanicus*** (p. 166)
–	Coxite with 99–111 group-hairs. Afghanistan	Sp. 2 (possibly a subsp. of *hindustanicus*)
14	Coxite with 90–220 group-hairs. Ventral process of style long (about 20 μm)	15
–	Coxite with 30–85 group-hairs. Ventral process of style long or short	16
15	Coxite very wide, whole group of 125–200 hairs on its basal half	***comatus*** (p. 166)
–	Coxite narrow, part of hair-group on its distal half	***balcanicus*** (p. 165)
16	Ventral process of style long	***zulfagarensis*** (p. 168)
–	Ventral process of style short	17
17	Whole hair-group (40–85) of coxite on its basal half	***salangensis*** (p. 168)
–	Part of hair-group on distal half of coxite	18
18	Antenna 3 = 1·20–1·55 times length of labrum. Coxite with 35–70 group-hairs	***angustus*** (p. 164)
–	Antenna 3 = 1·05–1·20 times length of labrum. Coxite with 30–50 group-hairs	***kyreniae*** (p. 167)

Phlebotomus **(*Adlerius*)** ***angustus*** Artemiev

(Map 10)

[*Phlebotomus* (*Adlerius*) *chinensis longiductus* Parrot; Lewis, 1967: 21 [in part]. Misidentification.]

[*Phlebotomus* (*Adlerius*) *longiductus* Parrot; Artemiev, 1974: 163 [in part]; Lewis, 1978*b*: 240 [in part]. Misidentifications.]

Phlebotomus (*Adlerius*) *angustus* Artemiev, 1978: 22 [♀ ♂]; 1980: 1189. Holotype ♂, AFGHANISTAN (MI, Moscow).

DISTRIBUTION. **Afghanistan**: Artemiev (1978: 22, in north and centre in high rocky mountains). **Pakistan**: Lewis (1967: 23, Gilgit area, i.e. Gilgit, Gol, Gwari, Keris and Parkuta; 84 ♂ of *Adlerius* from this area examined in 1979 found to be a mixture of *P. angustus* and *salangensis*). **U.S.S.R.**: Artemiev (1978: 22, Tadjikistan and Uzbekistan).

In Afghanistan *P. angustus* occurs in high rocky mountains (Artemiev, 1978: 22).

Phlebotomus **(*Adlerius*)** ***arabicus*** Theodor

(Map 10)

Phlebotomus (*Adlerius*) *chinensis arabicus* Theodor, 1953: 120 [♀ ♂]; Artemiev, 1974: 163. Syntypes 2 ♀, 1 ♂, YEMEN (BMNH).

Phlebotomus chinensis arabicus Theodor; Abonnenc & Minter, 1965: 32; Abonnenc, 1972: 111.
Phlebotomus (*Adlerius*) *arabicus* Theodor; Artemiev, 1980: 1190.

DISTRIBUTION. **Ethiopia (?)**: Ashford (1974: 610). **Saudi Arabia**: Büttiker & Lewis (1980). **Yemen**: Büttiker & Lewis (1978: 371); Theodor (1953: 120).

Phlebotomus* (*Adlerius*) *balcanicus Theodor

(Map 10)

[*Phlebotomus chinensis* Newstead; Nitzulescu, 1930*a*: 367 [♀ ♂]. Misidentification.]
Phlebotomus (*Adlerius*) *chinensis balcanicus* Theodor, 1958: 28 [differs in some respects from Nitzulescu's form but has similar hair-group on coxite]; Theodor & Mesghali, 1964: 292; Dancescu, 1967: 426; 1968: 189; Perfil'ev, 1968: 290; Léger, Saratsiotis, Pesson & Léger, 1979: 23, 24 [found variants which cast doubt on status of taxon]. Holotype ♂, GREECE (BMNH).
Phlebotomus (*Adlerius*) *balcanicus* Theodor; Artemiev, 1980: 1188 [raised to species].

DISTRIBUTION. **South-east Europe**: Theodor (1958: 29). **Crete**: (as *P. chinensis*) Hadjinicolaou (1958: 974); Hertig (1949*a*: 788, 789). **Greece**: (as *P. chinensis*) Hadjinicolaou (1958: 968, 970, 972); Hertig (1949*a*: 781–786); Léger *et al.* (1979: 17); Theodor (1958: 28, Yannitsa). **Iran**: Theodor & Mesghali (1964: 293). **Rumania**: Duport *et al.* (1971: 388, 389). **Turkey**: Yasarol (1980). **U.S.S.R.**: Dergacheva (1977: 1572, Azerbaydzhan). **Yugoslavia**: Zivković (1974: 4, map).

NOTE. This species may transmit VL in Greece (Léger *et al.*, 1979: 23).

Phlebotomus* (*Adlerius*) *brevis Theodor & Mesghali

(Map 10)

Phlebotomus (*Adlerius*) *chinensis brevis* Theodor & Mesghali, 1964: 293 [♀ ♂]. Holotype ♂, IRAN (IPH, Tehran).
Phlebotomus (*Adlerius*) *chinensis ismailicus* Perfil'ev, 1966: 314 [♂]; 1968: 288 [♀]. Type(s), U.S.S.R.: Ismail (ZI, Leningrad?). [Synonymized by Artemiev, 1980: 1183.]
Phlebotomus (*Adlerius*) *brevis ismailicus* Perfil'ev; Artemiev & Dergacheva, 1977: 1574.
Phlebotomus (*Adlerius*) *brevis* Theodor & Mesghali; Artemiev & Dergacheva, 1977: 1572 ['*chinensis*' from Agdam area of Azerbaydzhan sympatric with *balcanicus* and *halepensis* and distinct from Chinese form]; Artemiev, 1980: 1183.

DISTRIBUTION. **Iran**: Nadim *et al.* (1978: 27, 28); Theodor & Mesghali (1964: 293). **Turkey**: Yasarol (1980). **U.S.S.R.**: Artemiev & Dergacheva (1977: 1574); Dzhavadov *et al.* (1978: 143, Astanty, Dzhalilabad, Khanaga and Tazakent).

Phlebotomus* (*Adlerius*) *chinensis Newstead

(Map 10)

Phlebotomus major var. *chinensis* Newstead, 1916: 191 [♀ ♂]; Foo-Hai, 1934: 498. Lectotype ♂, CHINA (BMNH), designated by Lewis, 1978*b*: 239 [examined].
Phlebotomus chinensis Newstead; Sinton, 1928: 306 [in part, synonymy]; 1932: 59; 1933: 418; Patton & Evans, 1929: 29, 83, 137, 151, 162, 166, 215, 219, 223, 227; Yao & Wu, 1941: 78; Guan *et al.*, 1980: 25 [variation].
Phlebotomus (*Adlerius*) *chinensis chinensis* Newstead; Theodor, 1958; Theodor & Mesghali, 1964: 292; Perfil'ev, 1968: 281; Lewis, 1978*b*: 239.
Phlebotomus (*Adlerius*) *chinensis* Newstead; Artemiev, 1980: 1183.

♂ (*extra fact*, China, Wo Fu Su Temple, 1–6.vii.1914, *R. A. B.*). Leg formula 100, 131, 83; 98, 160, 95; 111, 188, 108 (0·81). Legs also examined by Nitzulescu (1930*a*: 365, 369) and Patton & Hindle (1926: 406).

RECORDED DISTRIBUTION. See note under subgenus. **China**: Guan *et al.* (1980, Gansu, Shanxi and Sichuan Provinces); He K'ai-zeng *et al.* (1959); Leng (1978: 7, no. 5 on map); Leng (1980, pers. comm., Qianshan); Leng & Chang (1964: 208); Lewis (1978*b*: 239, 325); Patton & Hindle (1928: 546, Chi-nan, Tsinan).

NOTE. *P. chinensis* is the vector of VL in China (Dedet, 1976: 421; Hoogstraal & Heyneman, 1969: 1185; Perfil'ev, 1968: 140; Theodor, 1964: 484; Wilcocks & Manson-Bahr, 1972: 121).

Phlebotomus* (*Adlerius*) *comatus Artemiev

(Map 10)

Phlebotomus (*Adlerius*) *comatus* Artemiev, 1978: 21 [♂]; 1980: 1188 [♀]. Holotype ♂, AFGHANISTAN (MI, Moscow).

The female is known but not described (Artemiev, 1979, *in litt.*).

DISTRIBUTION. **Afghanistan**: Artemiev (1978: 21). **Nepal** (?): Chobhar (1976, *J. W. N.*, ♀ only examined).

NOTE. In Afghanistan *P. comatus* is a rare species of rocky mountains between 1000 and 2600 m (Artemiev, 1978: 21).

Phlebotomus* (*Adlerius*) *davidi Artemiev

(Map 10)

[*Phlebotomus* (*Adlerius*) *chinensis arabicus* Theodor; Lewis, 1974: 189; Lewis & Büttiker, 1980: 263. Misidentifications.]
[?*Phlebotomus chinensis* Newstead; Ashford, 1974: 610 [very like *arabicus*]. Misidentification.]
Phlebotomus (*Adlerius*) *davidi* Artemiev, 1980: 1191 [♀ ♂]. Holotype ♂, YEMEN: Ta'izz (MI, Moscow).

DISTRIBUTION. **Ethiopia**: Artemiev (1980, probably this species). **Yemen**: Ta'izz.

Phlebotomus* (*Adlerius*) *halepensis Theodor

(Map 10)

Phlebotomus (*Adlerius*) *chinensis halepensis* Theodor, 1958: 29 [♀ ♂]; Mesghali, 1963: 1075; Theodor & Mesghali, 1964: 293; Perfil'ev, 1968: 291. Syntypes, IRAN, SYRIA (BMNH).
?*Phlebotomus chinensis monticola* Tarvit-Gontar, 1956: 158; Perfil'ev, 1968: 295 [position doubtful]. Type(s), U.S.S.R. (depository unknown). [Junior primary homonym of *Phlebotomus monticolus* Lima, 1932.]
Phlebotomus (*Adlerius*) *halepensis* Theodor; Artemiev, 1980: 1190.

DISTRIBUTION. **Iran, north Syria and U.S.S.R.**: Theodor (1958: 29). **Iran**: Nadim *et al.* (1977: 215; 1978: 27, 28); Theodor & Mesghali (1964: 293, Tehran etc.). **Israel**: Dishon (= Deishum, 28.vii.1942, det. *O. T.*). **Syria**: Theodor & Mesghali (1964: 293, Aleppo). **Turkey**: Yasarol (1980). **U.S.S.R.**: Artemiev & Dergacheva (1977: 1572); Theodor & Mesghali (1964: 293, Tbilisi).

NOTE. *P. monticola* might be a synonym of *P. halepensis* but the name must be permanently rejected as a junior primary homonym of *P. monticolus* Lima, 1932: 50 (ICZN, 1964: Articles 53, 57 and 57(b)).

In the U.S.S.R. (Perfil'ev, 1935: 96, map; 1968: 89) '*P. chinensis*' occurs as far north as 47° in the southern Ukraine, in a part of East Kazakhstan with a mean winter temperature of −16°C, and up to 2800 m.

'*P. chinensis*' appears to be a vector of *Le. donovani* in Gruziya (Perfil'ev, 1968: 142) and possibly in Turkestan (Theodor, 1964: 485) and was considered to be a main vector in Transcaucasia, Central Asia and Kazakhstan (Sergiev, 1979: 208).

Phlebotomus* (*Adlerius*) *hindustanicus Theodor

(Map 10)

[*Phlebotomus chinensis* Newstead; Sinton, 1928: 306 [in part]. Misidentification.]
Phlebotomus (*Adlerius*) *chinensis hindustanicus* Theodor, 1958: 29, 30 [♀ ♂]. Syntypes ♂, NORTH-WEST OF INDIAN SUBCONTINENT (BMNH).
[*Phlebotomus* (*Adlerius*) *chinensis longiductus* Parrot; Lewis, 1967: 21 [in part]. Misidentification.]
Phlebotomus (*Adlerius*) *hindustanicus* Theodor; Artemiev, 1978: 23 [and a possible variant classed as Species 1]; 1980: 1191.

DISTRIBUTION. **Afghanistan**: Artemiev (1978: 23, Gorband valley, Mahi-Par, 34°39′N, 69°42′E and Sarobi; in low rocky mountains). **India**: Bin Sar in Uttar Pradesh (BMNH); Kasauli (*J. A. S.*); Tapoban village in Chamoli district (13.vi.1969, *V. D.*). **Pakistan**: Rawalpindi (1959, *H. C. B.*; all 11 ♂ *Adlerius* examined in 1979 were this species). **Nepal:** Chobhar (1976, *J. Wn.*).

NOTE. In Afghanistan *P. hindustanicus* occurs in low rocky mountains (Artemiev, 1978: 23).

Phlebotomus* (*Adlerius*) *kabulensis Artemiev

(Map 10)

Phlebotomus (*Adlerius*) *kabulensis* Artemiev, 1978: 21 [♀ ♂]; 1980: 1188. Holotype ♂, AFGHANISTAN (MI, Moscow).

DISTRIBUTION. **Afghanistan**: 'Gorband', Kabul, Kandahar and Pangshir (Artemiev, 1978).

NOTE. This species is found in dwellings and is rather thermophilic and hydrophilic.

Phlebotomus* (*Adlerius*) *kyreniae Theodor

(Map 11)

[*Phlebotomus chinensis* Newstead; Adler, 1946: 498 [♀ ♂]; Theodor, 1953: 120. Misidentifications.]
Phlebotomus (*Adlerius*) *chinensis kyreniae* Theodor, 1958: 29 [♀ ♂]. Syntypes ♀ ♂, CYPRUS (BMNH).
Phlebotomus (*Adlerius*) *kyreniae* Theodor; Artemiev, 1980: 1185.

DISTRIBUTION. **Cyprus**: Theodor (1978). **Turkey**: Yasarol (1980).

NOTE. This form probably transmits canine kala-azar in Cyprus (Adler, 1946: 510; Lupascu *et al.*, 1977: 192).

Phlebotomus* (*Adlerius*) *longiductus Parrot

(Map 11)

Phlebotomus major var. *longiductus* Parrot, 1928: 29 [♂]; 1940: 310 [in part; ascoid formula of '*longiductus*' variable]; 1946: 68; Nitzulescu, 1929: 430. Syntypes 2 ♂, U.S.S.R.: Shakrisyabz near Samarkand (depository unknown).
[*Phlebotomus chinensis* Newstead [in part]; Nitzulescu, 1930*a*: 373 [?]. Misidentification.]
Phlebotomus chinensis var. *longiductus* Parrot; Nitzulescu, 1931*a*: 264 [♀].
Phlebotomus (*Adlerius*) *chinensis* var. *longiductus* Parrot; Theodor, 1948: 107.
Phlebotomus (*Adlerius*) *chinensis longiductus* Parrot; Theodor, 1958: 29 [in part]; Perfil'ev, 1968: 285; Dancescu, Cristescu, Costin *et al.*, 1970: 57.
Phlebotomus (*Adlerius*) *chinensis tauriae* Perfil'ev, 1966: 286; 1968: 62, 286. Type(s), U.S.S.R.: Crimea (MI, Moscow?) [Synonymized by Artemiev, 1978: 20.]
Phlebotomus chinensis tanriae Perfil'ev; Saladze, 1972: 617. [Mis-spelling.]
Phlebotomus (*Adlerius*) *longiductus* Parrot; Artemiev, 1974: 163 [in part]; 1978: 20; 1980: 1190.

DISTRIBUTION. **Afghanistan**: Artemiev (1978: 20, north and centre). **Rumania**: Artemiev (1978: 20); Dancesco *et al.* (1970: 60, map); Duport *et al.* (1971). **U.S.S.R.**: Artemiev (1978: 20, Central Asia, Crimea, Kazakhstan, northern Caucasus and southern Ukraine); Gaibov (1975*b*, rare in Fergana area); Saladze (1972: 617, Mtshketa district).

NOTE. In Afghanistan *P. longiductus* occurs in houses in plains between 1000 and 2000 m and is very anthropophilic; in the mountains of Kazakhstan it is the main vector of VL (Artemiev, 1978: 20).

Phlebotomus* (*Adlerius*) *rupester Artemiev

(Map 11)

Phlebotomus (*Adlerius*) *rupester* Artemiev, 1978: 21 [♀ ♂]; 1980: 1188. Holotype ♂, AFGHANISTAN (MI, Moscow).

NOTE. In Afghanistan *P. rupester* occurs in very high rocky mountains up to 3300 m (Artemiev, 1978: 21)

Phlebotomus (*Adlerius*) *salangensis* Artemiev

(Map 11)

Phlebotomus (*Adlerius*) *salangensis* Artemiev, 1978: 22 [♀ ♂]; 1980: 1189. Holotype ♂, AFGHANISTAN (MI, Moscow).

Phlebotomus (*Adlerius*) *simici* Nitzulescu

(Map 11)

Phlebotomus chinensis var. *simici* Nitzulescu, 1931*a*: 264 [♀ ♂]. Syntypes ♀ ♂, YUGOSLAVIA (IH, Skoplje?).
Phlebotomus (*Phlebotomus*) *chinensis* var. *simici* Nitzulescu; Parrot, 1941*a*: 45.
Phlebotomus (*Adlerius*) *simici* Nitzulescu; Theodor, 1958: 31; Perfil'ev, 1968: 282, 293; Artemiev, 1974: 164; 1980: 1185; Léger, Saratsiotis, Pesson & Léger, 1979: 24.
Phlebotomus (*Adlerius*) *chinensis simici* Nitzulescu; Houin, Abonnenc & Deniau, 1971: 642.

DISTRIBUTION. **Balkans, Iran, Syria and Turkey**: Theodor (1958: 32). **Crete**: Hertig (1949*a*: 787). **Greece**: Léger *et al.* (1979: 17). **Turkey**: Houin *et al.* (1971: 642); Yasarol (1980). **U.S.S.R.**: Gaibov (1975*b*, Fergana area); Perfil'ev (1968: 285, central Asia and Transcaucasia). **Yugoslavia**: Nitzulescu (1931*a*: 265, Skoplje); Simić & Živković (1956: 383–385, Hercegovina, Kosovo i Metohija, Makedonija and Serbia).

NOTE. *P. simici* is a vector of VL in the eastern Mediterranean area (Theodor, 1964: 480) and is considered to be one in Yugoslavia (Lupascu *et al.* 1977: 192).

Phlebotomus (*Adlerius*) *turanicus* Artemiev

(Map 11)

Phlebotomus (*Adlerius*) *simici turanicus* Artemiev, 1974: 163 [♀ ♂]. Types 6 ♀, 4 ♂, AFGHANISTAN (MI, Moscow).
Phlebotomus (*Adlerius*) *turanicus* Artemiev, 1978: 20; 1980: 1185.

DISTRIBUTION. **Afghanistan**: Artemiev (1978: 20, Aliabad etc. in north, probably also in Iran). **U.S.S.R.**: Artemiev (1978: 20, southern Tadzhikistan, southern Turkmeniya and southern Uzbekistan).

NOTE. In Afghanistan *P. turanicus* seems to be thermophilic and xerophilic and can stand a cold winter, is found mainly in rodent and bird burrows and sometimes in houses, and will attack man (Artemiev, 1978: 20).

Phlebotomus (*Adlerius*) *zulfagarensis* Artemiev

(Map 11)

Phlebotomus (*Adlerius*) *zulfagarensis* Artemiev, 1978: 22 [♀ ♂]; 1980: 1189. Holotype ♂, U.S.S.R. (MI, Moscow).

DISTRIBUTION. **Iran**: Artemiev (1978: 22). **U.S.S.R.**: Artemiev (1978: 22, Turkmeniya).

Subgenus ***EUPHLEBOTOMUS*** Theodor

Phlebotomus subgenus *Euphlebotomus* Theodor, 1948: 98; 1958: 32; Perfil'ev, 1968: 33 [parameres], 34, 78, 83; Hennig, 1972: 53; Lewis, 1978*b*: 240; Artemiev, 1979: 19 [key to ♂ including one species not described]. Type-species: *Phlebotomus argentipes* Annandale & Brunetti, 1908, by original designation.

Key to the species and subspecies of subgenus *Euphlebotomus*

Females

1 Spermatheca bulbous with faint striations near duct, with head on a distinct narrow neck. Pharyngeal armature comprising five or six anterior rows of grouped spicules and many minutely spiculate transverse ridges . . . . ***tumenensis*** (p. 170)
– Spermatheca not bulbous, without narrow neck. Pharyngeal armature comprising distinct teeth or ridges 2
2 Spermatheca with faint transverse striations or indistinct segments 3
– Spermatheca distinctly segmented 4

3 Spermatheca with large apical segment and about 15 indistinct segments. Pharynx with many uniform teeth . . . **mesghalii** (p. 170)
– Spermatheca with small apical segment and about 30 transverse striations. Pharynx with a median group of small teeth and, behind them, some close-set concentric lines **kiangsuensis** (p. 170)
4 Spermathecal common duct with rather thin walls. Antenna 5 without papilla . **argentipes** (p. 169)
– Spermathecal common duct with thick walls. Antenna 5 with papilla . . . 5
5 Antenna 3/labrum 1·0 . . . **philippinensis philippinensis** (p. 170)
– Antenna 3/labrum 1·4 . . . **philippinensis gouldi** (p. 170)

Males

1 Paramere with two lobes . . . **mesghalii** (p. 170)
– Paramere with three lobes . . . 2
2 Middle lobe of paramere nearly rectangular . . . **caudatus** (p. 169)
– Middle lobe of paramere with rounded end . . . 3
3 Middle lobe of paramere thicker than main (upper) lobe . . . **kiangsuensis** (p. 170)
– Middle lobe of paramere thinner than main lobe . . . 4
4 Main lobe of paramere much more than twice length of middle lobe, lower lobe narrow, depth of paramere about 0·29 of its length (measured to junction with coxite) . . **argentipes** (p. 169)
– Main lobe of paramere about twice length of middle lobe . . . 5
5 Aedeagus without accessory spines . . . **tumenensis** (p. 170)
– Aedeagus with accessory spines.
Lower lobe of paramere appearing narrow but extending mesally, depth of paramere about 0·35 of its length . . . 6
6 Antenna 3/labrum 1·7. Style 0·54 length of coxite, and more than four times as long as thick **philippinensis philippinensis** (p. 170)
– Antenna 3/labrum 2·0. Style 0·61 length of coxite, and about three times as long as thick **philippinensis gouldi** (p. 170)

Phlebotomus* (*Euphlebotomus*) *argentipes Annandale & Brunetti

(Map 12)

Phlebotomus argentipes Annandale & Brunetti *in* Annandale, 1908: 101 [♀ ♂]; Summers, 1911: 108; Patton & Evans, 1929: 228. Lectotype ♂, INDIA (ZSI, Calcutta), designated by Quate, 1962*a*: 157.

Phlebotomus (*Euphlebotomus*) *argentipes* Annandale & Brunetti; Perfil'ev, 1968: 61 [egg]; Lewis, 1978*b*: 240 [synonymy including *annandalei*, *marginatus* (apparently lost, according to Quate, 1962*a*: 157) and *zeylanicus* ♂ as synonyms]; Artemiev, 1978: 24; Killick-Kendrick, 1978: 309 [variation].

♀ (*extra facts*). Leg formula (two from West Malaysia, Lamir) 100, 126, 79; 97, 154, 95; 107, 182, 135 (2·23, 0·85); 100, 129, 76; 98, 148, 94; 107, 165, 104; (India, Ranighat) 100, 125, 75; 95, 151, 93; 106, 180, 108.
♂. Shaft of haltere 0·15 length of wing.

DISTRIBUTION. **The Orient**: Lewis (1978*b*: 325, map). **India**: Modi *et al.* (1978: 748, Maharashtra, map). Pandya *et al.* (1977: 133). The record from Iran by Javadian (1975: 207) was omitted by Artemiev (1978) and appears to be incorrect.

NOTE. Lewis (1978*b*: 323, 330, 331) summarized aspects of this species and reported geographical variation which was partly associated with differences in feeding habits. Spiculate ascoids were noted in India by S. Das (1973, *in litt.*). *S. argentipes* is an important vector of VL in India (Adler, 1964: 69; Bray, 1974: 93; Hoogstraal & Heyneman, 1969: 1186; Perfil'ev, 1968: 141; Shanmugham *et al.*, 1977: 796; Theodor, 1964: 482; Wilcocks & Manson-Bahr, 1972: 122). Houses were sprayed against malaria vectors in the early 1950s but *P. argentipes* seemed likely to flourish in neighbouring vegetation (Anonymous, 1955). Kala-azar, greatly reduced during the anti-malarial campaign, broke out on a large scale in 1977 (Killick-Kendrick, 1978: 306) when both spraying and treatment seemed necessary to cope with it. By 1978 control was not complete (Anonymous, 1978).

Phlebotomus* (*Euphlebotomus*) *caudatus Artemiev

(Map 12)

Phlebotomus (*Euphlebotomus*) *caudatus* Artemiev, 1978: 25; 1979: 17 [♂]. Holotype ♂, AFGHANISTAN: Farah-Rud area (BMNH) [examined].

NOTE. In Afghanistan *P. caudatus* occurs in low desert mountains (Artemiev, 1978: 25).

Phlebotomus (*Euphlebotomus*) *kiangsuensis* Yao & Wu

(Map 12)

Phlebotomus kiangsuensis Yao & Wu, 1938: 527 [♀ ♂]. Holotype ♂, CHINA (CFHS, Nanking?).
Phlebotomus (*Euphlebotomus*) *kiangsuensis* Yao & Wu; Lewis, 1978*b*: 244 [synonymy].

DISTRIBUTION. **China, Taiwan and West Malaysia**: Lewis (1978: 245). **China**: Leng (1978: 7, no. 10 on map).

Phlebotomus (*Euphlebotomus*) *mesghalii* Rashti & Nadim

(Map 12)

Phlebotomus (*Euphlebotomus*) *mesghalii* Rashti & Nadim, 1970: 145 [♀ ♂]; Artemiev, 1978: 24. Holotype ♂, IRAN (IPH, Tehran).

In the original description the names *mesghali* and *mesghalii* were both used, obviously for the same taxonomic unit. As first reviser, within the meaning of ICZN (1964), Article 24 (a) (i), I here select *mesghalii* as the name which will ensure stability of nomenclature.

A possible variant in Afghanistan is provisionally classed as species 2 by Artemiev (1978: 25).

Phlebotomus (*Euphlebotomus*) *philippinensis* Manalang

Phlebotomus philippinensis Manalang, 1930: 175.

Phlebotomus (*Euphlebotomus*) *philippinensis gouldi* Lewis

(Map 12)

Phlebotomus (*Euphlebotomus*) *philippinensis gouldi* Lewis, 1978*b*: 245 [♀ ♂]. Holotype ♀, THAILAND (BMNH) [examined].

Phlebotomus (*Euphlebotomus*) *philippinensis philippinensis* Manalang

(Map 12)

Phlebotomus philippinensis Manalang, 1930: 175 [♀ ♂]. Syntypes ♀ ♂, PHILIPPINES (CA, Los Baños (?) but destroyed according to Quate & Rosario, 1962: 787, 789, 791).
Phlebotomus (*Euphlebotomus*) *philippinensis philippinensis* Manalang; Lewis, 1978*b*: 245 [synonymy].

♀ (*extra fact*). Leg formula 100, 133, 89; 111, 155, 100; 111, 178, 111.

DISTRIBUTION. **Philippines**: Lewis (1978*b*: 325, map).

Phlebotomus (*Euphlebotomus*) *tumenensis* Wang & Chang

(Map 12)

Phlebotomus tumenensis Wang & Chang, 1963: 511 [♀ ♂]. Syntypes ♀ ♂, CHINA: Tumen, 31°46′N, 104°06′E (PIPD, Shandong).
Phlebotomus (*Euphlebotomus*) *tumenensis* Wang & Chang; Artemiev, 1979: 19.

Subgenus *ANAPHLEBOTOMUS* Theodor

Phlebotomus subgenus *Anaphlebotomus* Theodor, 1948: 99; Perfil'ev, 1968: 67, 78, 83; Hennig, 1972: 53; Lewis, 1978*b*: 247. Type-species: *Phlebotomus stantoni* Newstead, 1914, by original designation.

Key to the species of subgenus *Anaphlebotomus*

Females

1 Spermatheca long (about eight times as long as wide) and tubular with very long duct. Afrotropical . . . . **rodhaini** (p. 170)
– Spermatheca not long and tubular. Oriental 2

2 Spermatheca slightly carrot-shaped with small end-segment, individual duct about four (possibly more) times length of spermatheca.
Sternal tubercle broad . . . . ***colabaensis*** (p. 171)

– Spermatheca spindle-shaped with very narrow cylindrical apical segment, duct short but common duct very long.
Ascoids long. Palp 3 with peg sensilla grouped around middle 3

3 Pharyngeal armature with antero-median numerous long pointed teeth which blend laterally with ridges. Individual ducts longer than spermathecae . . . . . . ***stantoni*** (p. 172)

– Pharyngeal armature with several antero-median rows of small short teeth, and antero-laterally a number of backward-pointing teeth. Individual ducts shorter than spermathecae . ***hoepplii*** (p. 171)

Males

1 Paramere bilobed . . . . ***colabaensis*** (p. 171)

– Paramere trilobed 2

2 Plunger of sperm pump much wider than body of barrel. Afrotropical . . . . ***rodhaini*** (p. 171)

– Plunger of sperm pump narrower than body of barrel. Oriental 3

3 Spine near aedeagus not longer than it. Pharynx with a series of oblique ridges radiating from mid-line and ending in loops laterally . . . . ***stantoni*** (p. 172)

– Spine near aedeagus much longer than it. Pharynx with a series of posterior ridges and, antero-laterally, a number of teeth projecting medio-posteriorly . . . . . . ***hoepplii*** (p. 171)

Phlebotomus (Anaphlebotomus) colabaensis Young & Chalam

(Map 13)

Phlebotomus colabaensis Young & Chalam, 1927: 859 [♂]. Holotype ♂, INDIA (CSI Kasauli, now in NICD, Delhi?).

Phlebotomus (*Anaphlebotomus*) *colabaensis* Young & Chalam; Lewis, 1978*b*: 247 [references including one to description of ♀ by Sinton in 1933].

Phlebotomus (*Anaphlebotomus*) *colobaensis* Young & Chalam; Artemiev, 1978: 24. [Mis-spelling.]

DISTRIBUTION. **India & Pakistan**: Lewis (1978*b*: 326, map). **India**: Delhi (1979, *S. J. R.*); Modi *et al.* (1977: 3; 1978: 748, map of Maharashtra).

Phlebotomus (Anaphlebotomus) hoepplii Tang & Maa

(Map 13)

Phlebotomus hoepplii Tang & Maa, 1945: 25 [♀♂]. Holotype ♂, CHINA (TM).

Phlebotomus (*Anaphlebotomus*) *hoepplii* Tang & Maa; Lewis, 1978*b*: 247 [references].

DISTRIBUTION. **China**: Leng (1978: 7, no. 9 on map); Lewis (1978*b*: 326, map).

Phlebotomus (Anaphlebotomus) rodhaini Parrot

(Map 13)

Phlebotomus rodhaini Parrot, 1930*a*: 187 [♂]; 1930*b*: 103; Kirk & Lewis, 1947: 875; Heisch & Guggisberg, 1952: 428. Holotype ♂, ZAIRE (MRAC, Tervuren).

Phlebotomus (*Phlebotomus*) *rodhaini* Parrot; Parrot, 1948: 127 [♀]; Kirk & Lewis, 1946*b*: 120; 1951: 437; Minter, 1963: 490; Quate, 1964: 245; Abonnenc & Minter, 1965: 32; Abonnenc, 1967: 70; 1972: 108.

Phlebotomus grenieri Rageau, 1951: 796 [♀]. Syntypes 2 ♀, CAMEROUN (IP, Paris). [Synonymized by Abonnenc, 1967: 70.]

Phlebotomus (*Anaphlebotomus*) *rodhaini* Parrot; Qutubuddin, 1962: 597.

DISTRIBUTION. **Africa**: Abonnenc (1972: 251, map). **Congo**: Vattier-Bernard & Bimangou (1974: 105). **Benin Republic and Togo**: Abonnenc (1973: 190, map). **Ethiopia**: Ashford (1974: 610); Gemetchu *et al.* (1977: 209). **Gambia**: Snow (1979: 245). **Guinea**: Abonnenc & Clastrier (1974: 61). **Kenya**: Minter (1964: 407, map); Kiboko (*D. M. M.*, record of 1980); Wijers & Ngoka (1974: 26). **Senegal**: (1977, *J. P. D.*). **Sudan**: Hoogstraal & Heyneman (1969: 1155); Lewis & Kirk (1954: 35, map); Qutubuddin (1962: 597, Gedaref). **Uganda**: Wykoff *et al.* (1969: 206).

NOTE. This species apparently feeds mainly on rodents (Abonnenc, 1972: 110) and has been known to bite man (Ashford, 1974: 610; Ashford *et al.*, 1973: 261; Hoogstraal & Heyneman, 1969: 1156, 1170).

Phlebotomus (*Anaphlebotomus*) sp. D

(Map 13)

This species is being described by Dr I. H. Davidson.

Phlebotomus (*Anaphlebotomus*) *stantoni* Newstead

(Map 13)

Phlebotomus stantoni Newstead, 1914: 190 [♀]; Leng, Liu, Huang & Liu, 1979: 189. Holotype ♀, WEST MALAYSIA (BMNH) [examined].

Phlebotomus (*Anaphlebotomus*) *stantoni* Newstead; Lewis, 1978*b*: 248 [synonymy including *maynei* as synonym and description of ♂ *P. stantoni* by Raynal in 1934].

DISTRIBUTION. **China and Orient**: Lewis (1978*b*: 326, map). **China**: Leng (1978: 7, no. 8 on map); Leng *et al.* (1979: 189, Ch'ang-chiang (= Zhanjiang)).

Subgenus ***KASAULIUS*** **subgen. n.**

Type-species: *Phlebotomus newsteadi* Sinton.

DIAGNOSIS. Pharynx of ♀ with well-developed teeth pointing backward. Antenna 3 long, 0·39 mm or more in ♀ and 0·52 or more in ♂; two ascoids on segments 3–15 in ♀, and 3–10 in ♂. Palp formula 1 (2, 4), 3, 5 in ♀ and 1, (4, 2), 3, 5 in ♂. Mesanepisternum with two lower hairs. Legs very long, in ♂ tibia 3 = 2·18, and basitarsus 3 = 1·36, as long as femur 1. Wing narrow, in ♀ about 4·3, and in ♂ 4·7, as long as wide; index 1·94–2·14 in ♀ and 1·5–2·3 in ♂. Haltere of ♂ with broad stalk, hind half marked off by a furrow and having a projecting group of large sensilla. Spermatheca moniliform with about 25 segments, the end one large. Genital filaments about twice length of pump. Aedeagus narrow, with two accompanying pointed rods. Paramere with truncated end having four small ventral serrations, a few hairs on a small projection, and an accessory spine. Coxite without group of hairs. Style with five spines.

DISCUSSION. Theodor (1948: 108) placed the single species provisionally in the subgenus *Euphlebotomus* although the description of the paramere did not indicate this, and Artemiev (1979: 19) considered that *P. newsteadi* was closest to *Euphlebotomus* in view of the lateral spine of the aedeagus and the shape of the paramere, coxite and style. The unique nature of this species is emphasized by its narrow wings and by comparison of its leg-segments with those of other species, and a new subgenus is therefore proposed for it. It is given a territorial name because *P. newsteadi*, though discovered 60 years ago, is known only from the one place.

Phlebotomus (*Kasaulius*) *newsteadi* Sinton

(Map 13)

Phlebotomus newsteadi Sinton, 1926: 559 [♂]; Lewis, 1978*b*: 250 [synonymy including description of ♀ by Sinton in 1928]; Artemiev, 1978: 24; 1979: 19 [related to *Euphlebotomus*?]. Lectotype ♂, INDIA (BMNH), designated by Lewis, 1978*b*: 250 [examined].

♂ (*extra facts*). Labrum 0·28 mm long, 0·59 length of head, 0·09 length of wing. Antenna 4 and 5 with papilla. Two lower mesanepisternal hairs present. Leg formula 100, 176, 119; 93, 194, 125; 106, 218, 136 (3·03, 0·20). Wing length 2·93 (2·84–3·03) mm long, 4·7 times width. Haltere shaft 0·19 length of wing.

MATERIAL EXAMINED

India: 1 ♂, Kasauli, 5.viii.1928, garden house (*J. A. S.*) (RSTMH, London).

NOTE. The rarity of this species and the relative lengths of the hind tibia and the basitarsi suggest that it may be a cave form seen rarely outside caves.

Nomen nudum

Phlebotomus algeriensis Jenkins, 1964: 31.

Discussion

Leg ratios (Figs 15–24)

The relative length of tibia 3 of a species was taken as an indicator of leg length, and species with a tibia 3 length of 165 units or less were classed as short-leg species, and the rest as long-leg species. For estimating the mean lengths in subgenera, figures for species were placed in working groups of 121–130, 131–140 and so on.

Phlebotomites brevifilis Hennig (120 MYA)

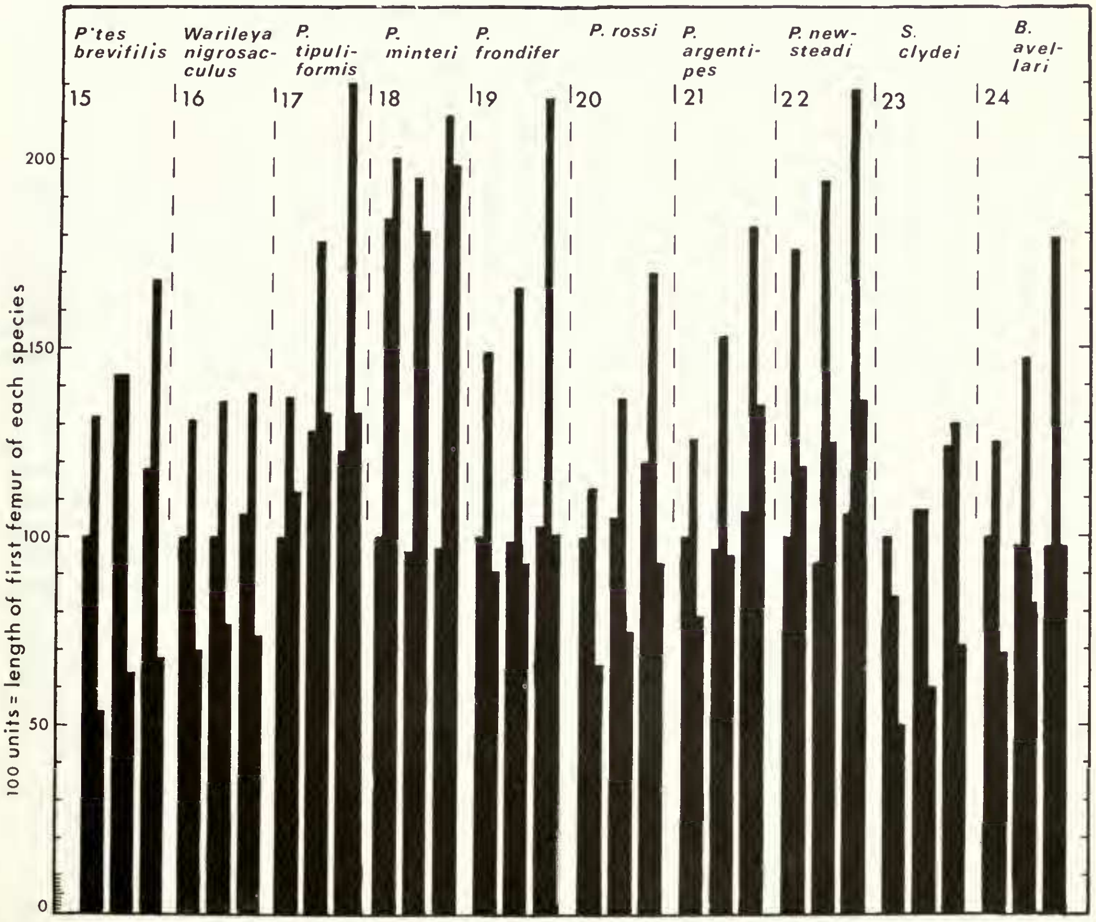
The leg formula appears to be 100, 132, 53; 143, 143, 64; 117, 168, 68 (0·41), with the three tibiae and the basitarsi approaching equality and tibia 1 and femur 2 very long.

Genus *Warileya*

The leg formula of the male of *W. nigrosacculus* is 100, 132, 70; 100, 136, 72; 106, 138, 74 (0·47), each leg being like the others, and tibia 3 very short. The remarkable degree of uniformity of this species may be related to that shown by the fossil forms.

Genus *Phlebotomus*

Out of 55 species studied the length of tibia 3 ranged from 155 to 218, and there were eight (14 per cent) short-leg species and 47 (86 per cent) long-leg species.



Figs 15–24 The relative lengths of long segments of each leg of 10 species of Phlebotominae.

Phlebotomus tipuliformis (Meunier) (30 MYA). The leg formula (Hennig, 1972: 52) appears to be 100, 137, 112; 128, 178, 133; 123, 220, 133 (0·49). All tibiae are long and tibia 3 very long, and the basitarsi longer than the femora and about equal to each other. If the measurements of flies in amber are reliable the two fossil species show a tendency to uniformity.

Subgenus *Spelaeophlebotomus.* One species was measured. Tibia 3 = 211. All tibiae and basitarsi are very long, probably as an adaptation to caves.

Subgenus *Idiophlebotomus.* Six species were measured. Tibia 3 = 197 (182–216). The tibiae and basitarsi show a tendency to uniformity, probably a primitive feature. Femur 1 is always longer than femur 2, and this and the long tibia 3 may represent an adaptation to life in caves.

Subgenus *Australophlebotomus.* Two species were measured. Tibia 3 = 155 (155–156).

Subgenus *Phlebotomus.* Four species were measured. Tibia 3 = 171 (163–175).

Subgenus *Paraphlebotomus.* Eight species were measured. Tibia 3 = 172 (153–194). In *P. alexandri* each tibia is shorter than in other species, and basitarsus 1 is shorter than femur 1 (longer in all other species). All the tibiae of *P. nuri* are longer than those of other species studied. Measurements of *P. sergenti* from Corsica and Morocco (Croset *et al.*, 1974: 107) and the U.S.S.R. indicate local variation.

Subgenus *Synphlebotomus.* Six species were measured. Tibia 3 = 165 (157–172) and there is little specific variation.

Subgenus *Larroussius.* Seventeen species were measured. Tibia 3 = 181 (147–212), one being below 150 and two above 200.

Subgenus *Adlerius.* Six species were measured. Tibia 3 = 182 (163–202).

Subgenus *Euphlebotomus.* Three species were measured. Tibia 3 = 180 (176–185).

Subgenus *Anaphlebotomus.* Four species were measured. Tibia 3 = 179 (167–189).

Subgenus *Kasaulius.* In the one species tibia 3 = 218.

Other genera

Records of 27 species of *Sergentomyia* show a variation of 124–229 in the length of tibia 3, even in this small sample, with 18 short-leg and nine long-leg species. Published records of three species of *Brumptomyia* show an average length of 184 (178–190) for tibia 3. Published records of 100 species, of 30 subgeneric groups, of *Lutzomyia* give a tibia 3 length of 136 to 230 units, with 42 short-leg and 58 long-leg species. Among groups represented by five or more species, the number of species considered and the mean length of tibia 3 were: *Psychodopygus* Mangabeira, 8, 169; *Pressatia* Mangabeira, 5, 161; *Helcocyrtomyia* Barretto, 9, 172; *Psathyromyia* Barretto, 7, 196; *verrucarum*-group, 10, 155.

Conclusion

The records for *P. papatasi* and *P. caucasicus* suggest that leg measurements differ little between the sexes, and the former shows little variation in a particular area. Extinct and some primitive species (*Phlebotomites*, *Warileya*, *P. tipuliformis*, *Spelaeophlebotomus* and *Idiophlebotomus*) show a trend towards equality of segment 1, 2 or 3 in successive legs. Most species of *Phlebotomus* show a pattern in which each femur, tibia and basitarsus is longer than the preceding one, and each tibia is somewhat longer, and each basitarsus much shorter, than its femur.

The length of tibia 3 in *Phlebotomus* tends to be greater than in *Sergentomyia* and *Brumptomyia*, and varies more than in *Brumptomyia* and less than in *Sergentomyia.* In all three genera the length of tibia 3 apparently constitutes a more or less clear-cut feature of several subgeneric groups, and in the case of *Kasaulius* it was a factor in deciding to treat this group as a subgenus. Certain species can be distinguished from others by the length of tibia 3. Some species with a similar tibia 3 length differ in the form of another leg, which may be useful if the others are missing. It is therefore worth while to examine all three legs, and to follow up differences suggested by leg diagrams. Infra-specific local variation seems to occur in at least one species (*P. sergenti*). These findings suggest that the measurement of all long leg segments of at least one female of a sandfly species yields enough information to be worth doing. Further work could provide averages instead of measurements of individual flies, indicate the length of tibia 3 in additional species, and evaluate any apparently distinctive specific characters.

Evolution of Phlebotominae

It is now possible to speculate on the history of *Phlebotomus* and some other sandflies on the basis of fossils, palaeogeography, morphology and distribution. The following remarks refer to the Old World unless the New is mentioned.

Old and New World sandfly faunas

Before 120 MYA Phlebotominae had probably lived for a long time in Pangaea, and possibly fed on insects before taking to vertebrate blood (Rohdendorf, 1974: 58). After the opening of the south Atlantic about that time the two sandfly faunas of Africa and South America probably evolved separately. It is not known whether this separation continued to the present day, because the north Atlantic did not open (Papavero, 1977: 212) till perhaps 60 MYA or later, there were probably land connections in the Bering area and elsewhere from time to time, and the effects of past polar and climatic changes on sandfly distribution are unknown. After the development of *Phlebotomus* its species probably did not extend far enough into the cold north to cross the Bering land bridge (Perfil'ev, 1968: 90). The present differences between Old and New World sandflies, though somewhat indefinite, are enough to suggest that isolation has prevailed for the last 120 MYA.

The proboscis in relation to reptile and mammalian hosts

According to present evidence nearly all living species of sandflies are either reptile or mammal feeders. In general the reptile feeders are distinguished morphologically as ridge-tip species, according to the shape of the maxilla and other stylets, and have a short labrum, not more than 0·23 mm long (Lewis, 1975: 507, 520, 525). Mammal feeders are hook-tip species, usually with a labrum 0·24 or more in length. Species of *Sergentomyia* typically have a labrum about 0·11 (0·09–0·14) as long as the wing, and *Phlebotomus* about 0·14 (0·11–0·22) as long, and the difference is usually accentuated by the greater size of species of *Phlebotomus*. Current studies on the mouth parts of early fossil-piercing psychodids, living in the age of reptiles and presumably ridge-tips, had a short labrum. It is likely that in reptile feeders the labrum has remained short, and that in mammal feeders it has progressively lengthened during the rise of mammals, so that now the two groups have a somewhat midge-like and mosquito-like facies respectively.

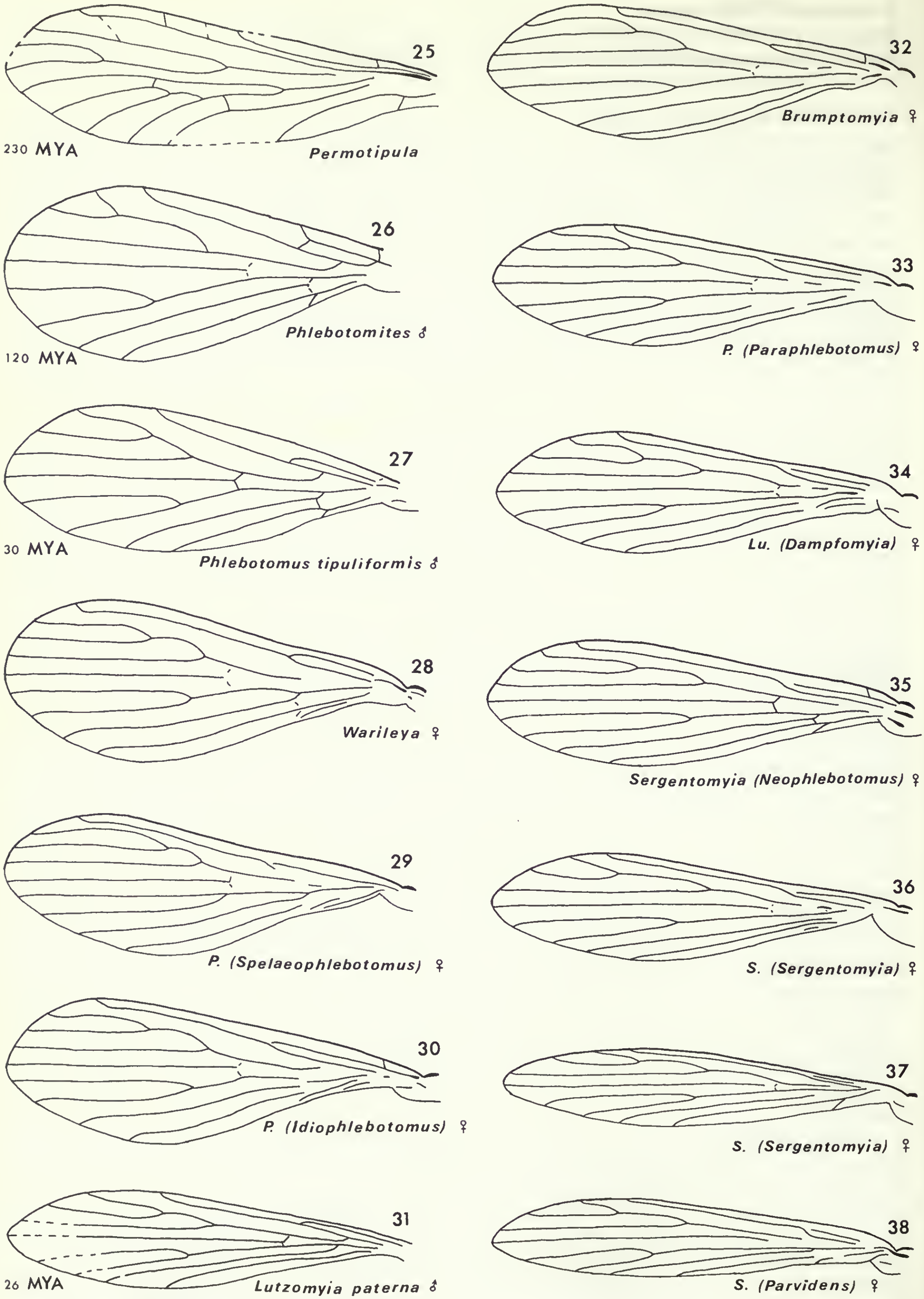
Wing shape

Wings vary from being very broad with round ends to being very narrow with almost pointed tips. There is no clear distinction between narrowly rounded and bluntly pointed tips, but there is generally little difficulty in dividing species as follows among four groups designated by typical values of wing length divided by width, although in a doubtful case a subjective view of shape may be better than exact measurement: very wide (3·2, Figs 26–30), wide (3·5, Figs 32–35), narrow (3·9 Fig. 36) and very narrow (5·5, Figs 37, 38).

Very wide wings are seen in *Phlebotomites* species and *Phlebotomus tipuliformis*, in the primitive *Warileya*, in the subgenera *Spelaeophlebotomus* and *Idiophlebotomus*, and in some species of subgenus *Australophlebotomus*. Except in this subgenus the wings are of a primitive type with the origin of R_4 near that of R_5 so that gamma is short (Abonnenc, 1972: 75). The closely related *Spelaeophlebotomus* and *Idiophlebotomus* share an archaic wing structure (Abonnenc, 1972: 74, 75). An interocular suture (Young, 1979: 5), presumably a primitive character, occurs (Lewis *et al.*, 1977: 326) in *Warileya* and *Spelaeophlebotomus*. *Idiophlebotomus* and most species (Young & Chaniotis, 1973; Lewis *et al.*, 1977: 325) of *Warileya* share the unusual feature of rods near the sperm pump.

In all other phlebotomines the origin of R_{2+3} has become distally displaced, the wing less wide, and its tip less rounded, possibly in relation to the development of a hairy fringe (Hennig, 1972: 8, 27). The first known narrowing occurred, in America, at least 26 MYA.

The wing tends to be wide, with R_2 longer than R_{2+3} (Theodor, 1958: 24, 33, 48; Perfil'ev, 1968: 26, more or less oval) in *Phlebotomus*, in subgenus *Neophlebotomus* França & Parrot and some ungrouped and other species of *Sergentomyia*, and in *Brumptomyia* and *Lutzomyia*. Included in *Phlebotomus* are the pair of closely related subgenera *Euphlebotomus* and *Anaphlebotomus* which somewhat resemble (Hennig, 1972: 53–55) the ancient *P. tipuliformis*, and their type



Figs 25–38 Wings of *Permotipula* and of examples of 13 groups of Phlebotominae to illustrate evolutionary trends.

of spermathecal duct suggested to Perfil'ev (1968: 83) that they are transitional between *Sergentomyia* and *Phlebotomus.* Their long parameral spines and those of *Kasaulius* may (Artemiev, 1979: 18) be homologous with the intra-abdominal rods of the primitive *Warileya* and *Idiophlebotomus.* In three subgenera of the wide-wing group, *Synphlebotomus, Euphlebotomus* and *Anaphlebotomus,* the mean length of the labrum is less than in *Phlebotomus, Paraphlebotomus, Larroussius* and *Adlerius,* and may indicate an earlier stage in evolution.

The wing is often narrow, lanceolate and nearly pointed, with R_2 shorter than R_{2+3} (Fairchild, 1955: 183; Theodor, 1958: 4; Perfil'ev, 1968: 26, 27, 295) in subgenera *Sintonius* Nitzulescu, *Grassomyia* Theodor, *Sergentomyia, Parrotomyia* Theodor and some ungrouped species of genus *Sergentomyia.*

Very narrow wings are seen in a few species of genus *Sergentomyia.*

It appears that the phlebotomine wing has gradually narrowed, particularly in *Sergentomyia* and mainly in its savanna species, so that now in the Old World reptile and mammal feeders usually have narrow and wide wings respectively.

Widespread and northern groups of Phlebotomus

If distribution is considered in relation to the above discussions on labrum length and wing shape it is possible to postulate two evolutionary groups of *Phlebotomus,* the widespread and northern groups. The former includes all except subgenus *Phlebotomus* and virtually all *Paraphlebotomus, Adlerius* and *Larroussius,* and the latter group comprises most species of these subgenera.

The widespread group shows a number of primitive or apparently primitive features, and in general is widely distributed (Maps 1, 5, 12, 13). The northern group seems to exhibit the ultimate stage in lengthening of the labrum, and has an extraordinarily north-western and restricted distribution in the Old World (Lewis, 1974: 364; 1978*a*: 97; Maps 2–4, 6–11) in relation to other Phlebotominae (the widespread group and *Sergentomyia,* Map 1), with little specific variation in distribution. It corresponds roughly with the distribution of moles, hedgehogs and jerboas (Bartholomew *et al.,* 1911) and also (Ellerman, 1950) of the gerbil genera *Meriones, Psammomys* and *Rhombomys* with which some sandflies are associated. Gerbils appeared late in geological time (Chaline, 1977) like many rodents (Petrishcheva, 1971: 569). The large northern group includes most of the Old World vectors of mammalian leishmaniasis.

It is suggested that the northern group increased in numbers of individuals, and in species except in subgenus *Phlebotomus,* in late geological times in the north-west, and that during the pluvial periods (Banister & Clarke, 1977: 147, 151; Roberts, 1975: 276) a few species extended into Ethiopia, Yemen and China. *P. orientalis,* closely related to the Mediterranean *P. langeroni,* may be a product of this process, and its present extension into the Sudan, but not far into West Africa (Map 8), could be a stage in its progress. In China species of *Phlebotomus* (Maps 3, 4, 10) may now be cut off from the west unless there is a connection along a corridor south of Mongolia (Perfil'ev, 1968: 96). Further spread of the northern cold-winter group may have been prevented by climatic factors and by natural barriers like the Sahara which has existed for a long time (Corbet, 1967: 334). The distribution of *P. papatasi* and *P. duboscqi* differs somewhat from that of the others, their subgenus is unusually small, and (Hennig, 1972: 53) they may be related to *Euphlebotomus,* so their history may possibly be different.

Aspects of leishmanial evolution in relation to that of Phlebotominae

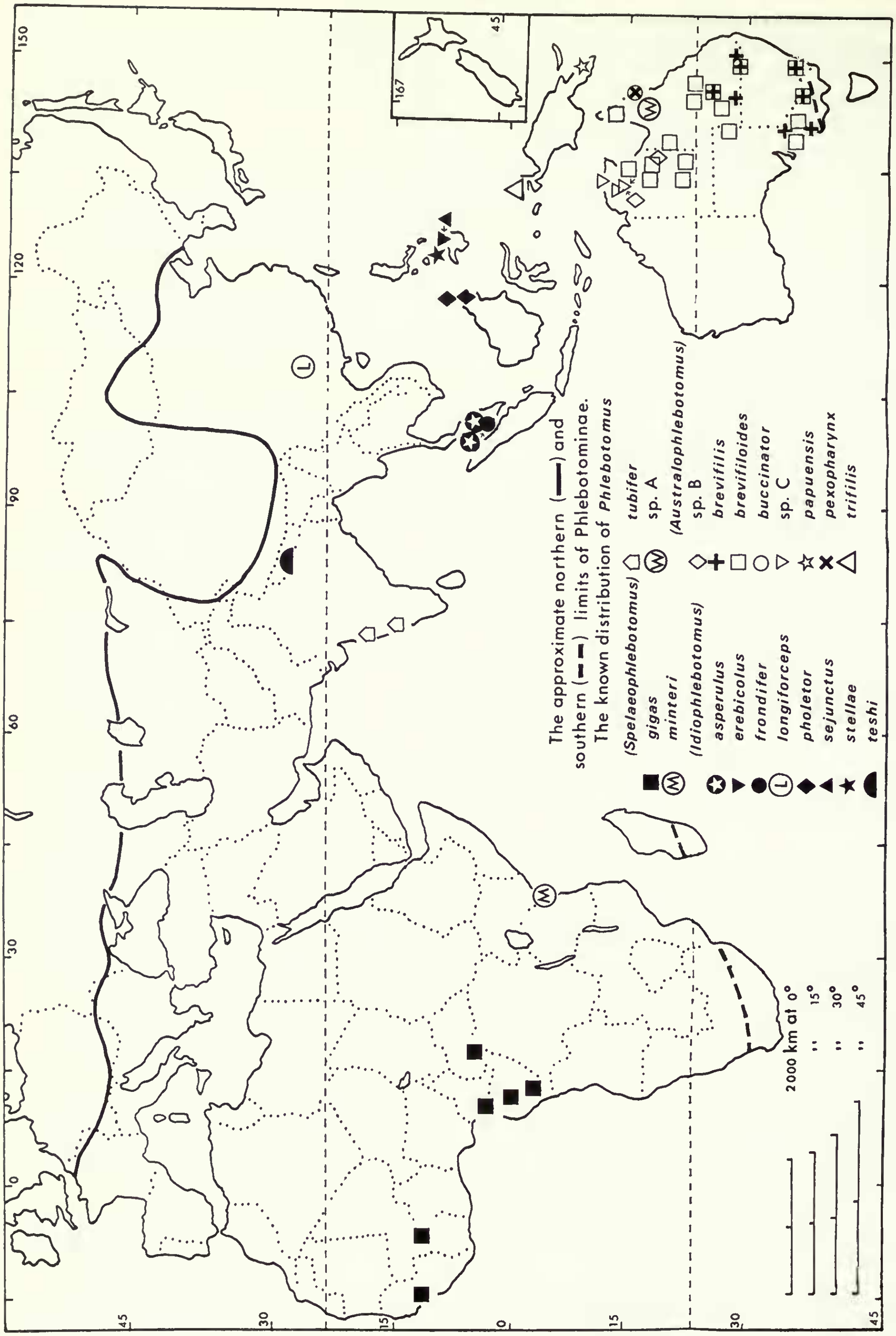
The availability of a few sandfly fossils and knowledge of the present distribution of leishmaniasis make it possible to speculate, as follows, on the history of *Leishmania* in a way that may have some bearing on the classification of the genus.

Before 120 MYA

In the ancient continent of Pangaea Phlebotominae may have acted as primary hosts of leishmaniae of reptiles for a long period.

120 to 20 MYA

In the New World some 120 MYA leishmaniae probably began to evolve in isolation from the Old Word, and this separation may have been continuous, or nearly so, till historic times and accounted for the considerable difference (Chance *et al.,* 1977: 59) between the parasites of Old


The approximate northern (——) and southern (— —) limits of Phlebotominae.
The known distribution of *Phlebotomus*
(*Spelaeophlebotomus*)
■ *gigas*
Ⓜ *minteri*
(*Idiophlebotomus*)
✪ *asperulus*
▶ *erebicolus*
● *frondifer*
Ⓛ *longiforceps*
◆ *pholetor*
▲ *sejunctus*
★ *stellae*
◗ *teshi*
⬠ *tubifer*
Ⓦ sp. A
(*Australophlebotomus*)
◇ sp. B
✚ *brevifilis*
□ *brevifiloides*
○ *buccinator*
▷ sp. C
☆ *papuensis*
✕ *pexopharynx*
△ *trifilis*
2000 km at 0°
,, 15°
,, 30°
,, 45°
150
120
90
60
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0
45
30
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15
30
45
167
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L
M
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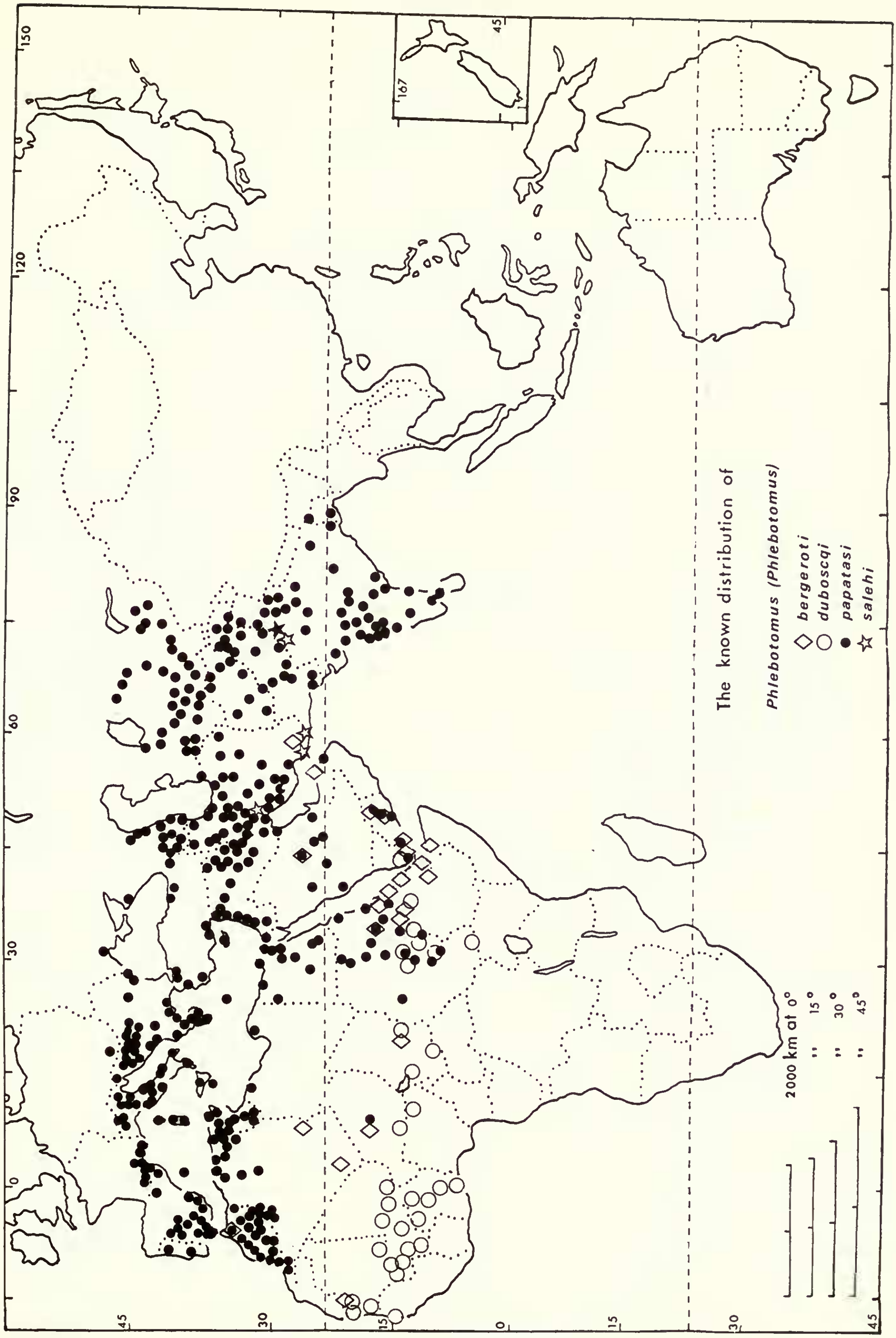
Map 1


The known distribution of
Phlebotomus (Phlebotomus)
◇ *bergeroti*
○ *duboscqi*
● *papatasi*
☆ *salehi*
2000 km at 0°
" 15°
" 30°
" 45°
150
120
90
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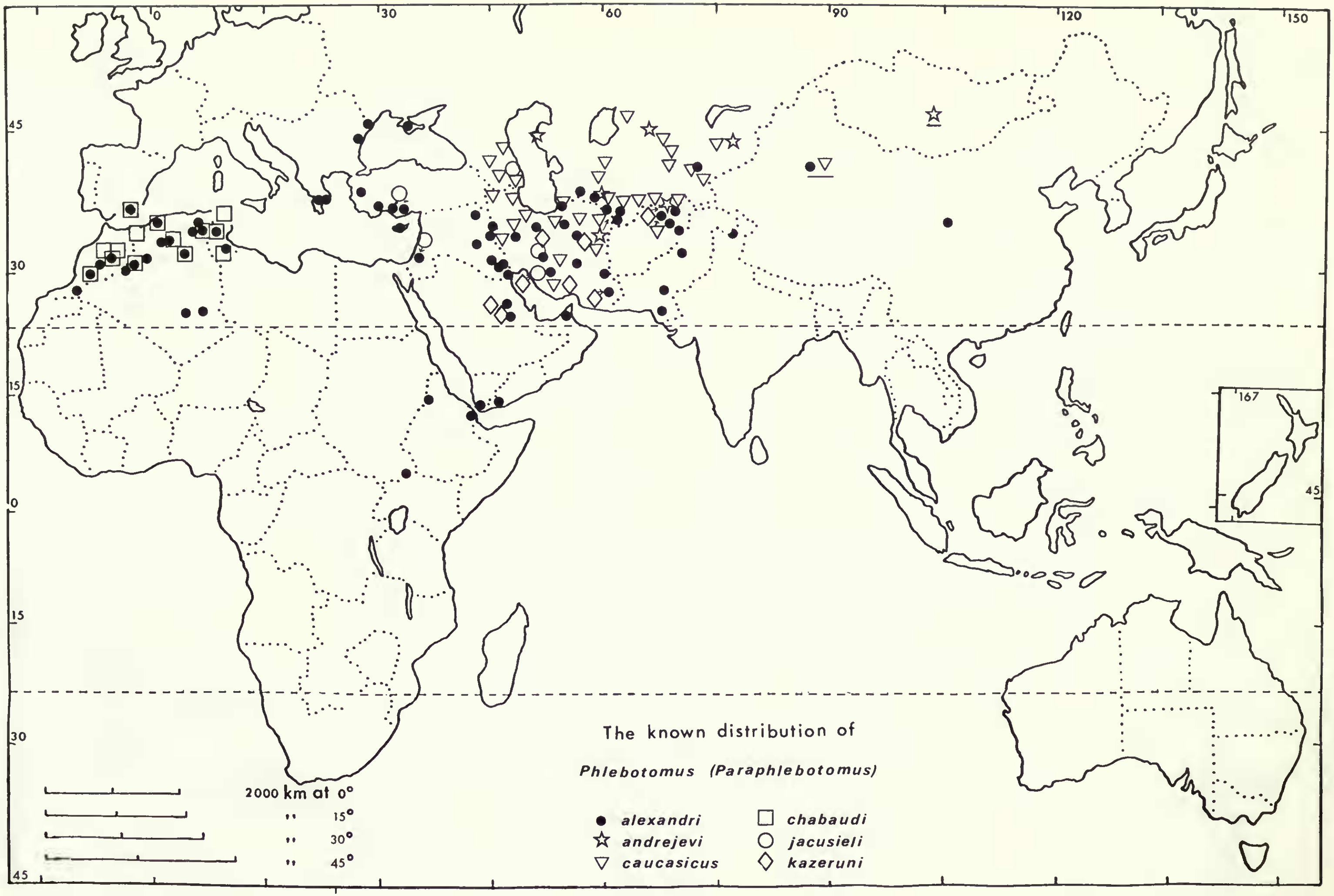
15
0
15
30
45
167
45

Map 2


The known distribution of
Phlebotomus (Paraphlebotomus)
● *alexandri*
☆ *andrejevi*
▽ *caucasicus*
□ *chabaudi*
○ *jacusieli*
◇ *kazeruni*
2000 km at 0°
" 15°
" 30°
" 45°
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120
150
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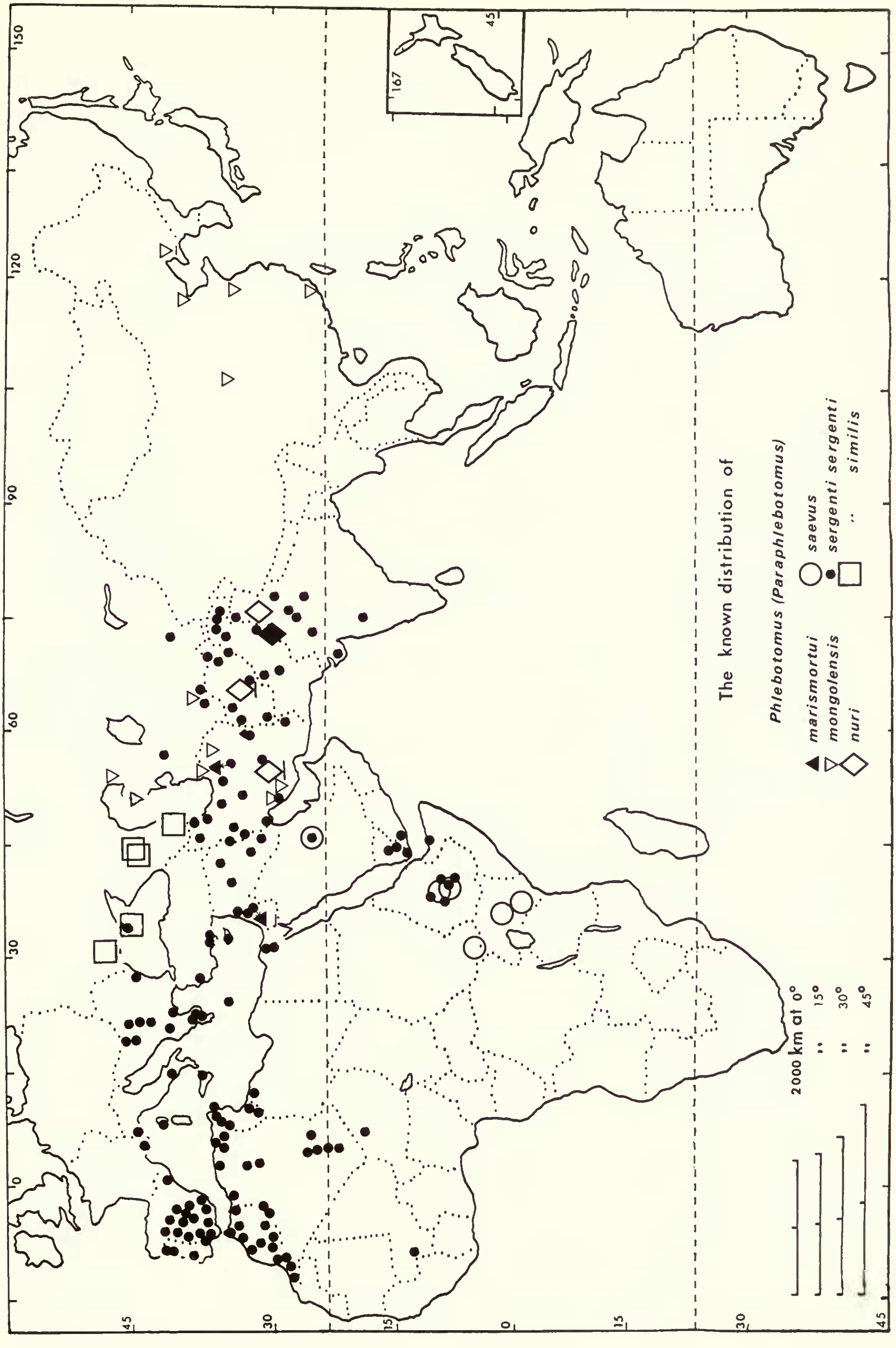
15
30
45
167
45

Map 3


The known distribution of
Phlebotomus (Paraphlebotomus)
▲ marismortui
▽ mongolensis
◇ nuri
○ saevus
● sergenti sergenti
□ " similis
2000 km at 0°
" 15°
" 30°
" 45°
150
120
90
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15
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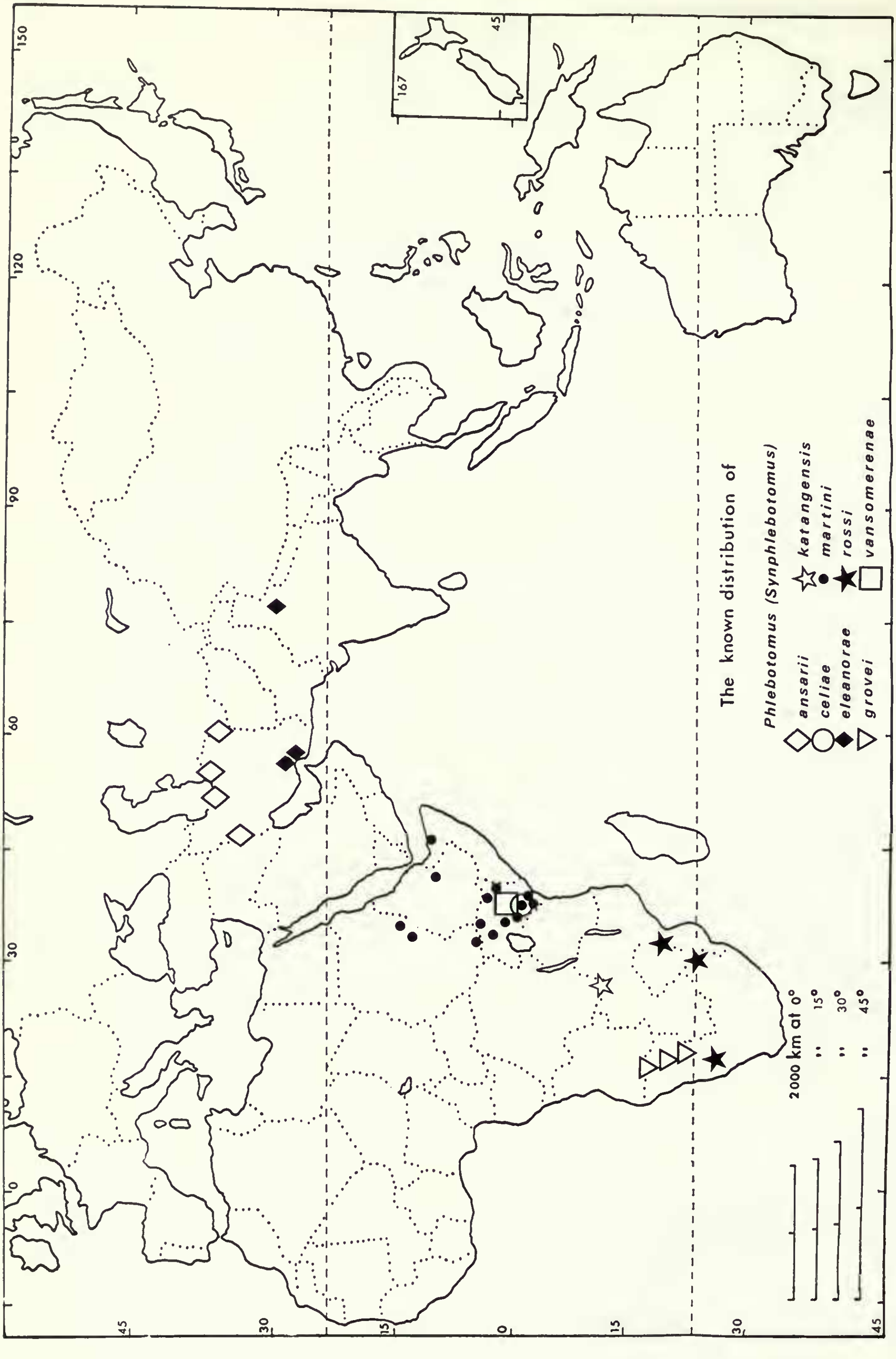
167
45

Map 4


The known distribution of
Phlebotomus (Synphlebotomus)
◇ ansarii
○ celiae
◆ eleanorae
▽ grovei
☆ katangensis
● martini
★ rossi
□ vansomerenae
2000 km at 0°
" 15°
" 30°
" 45°
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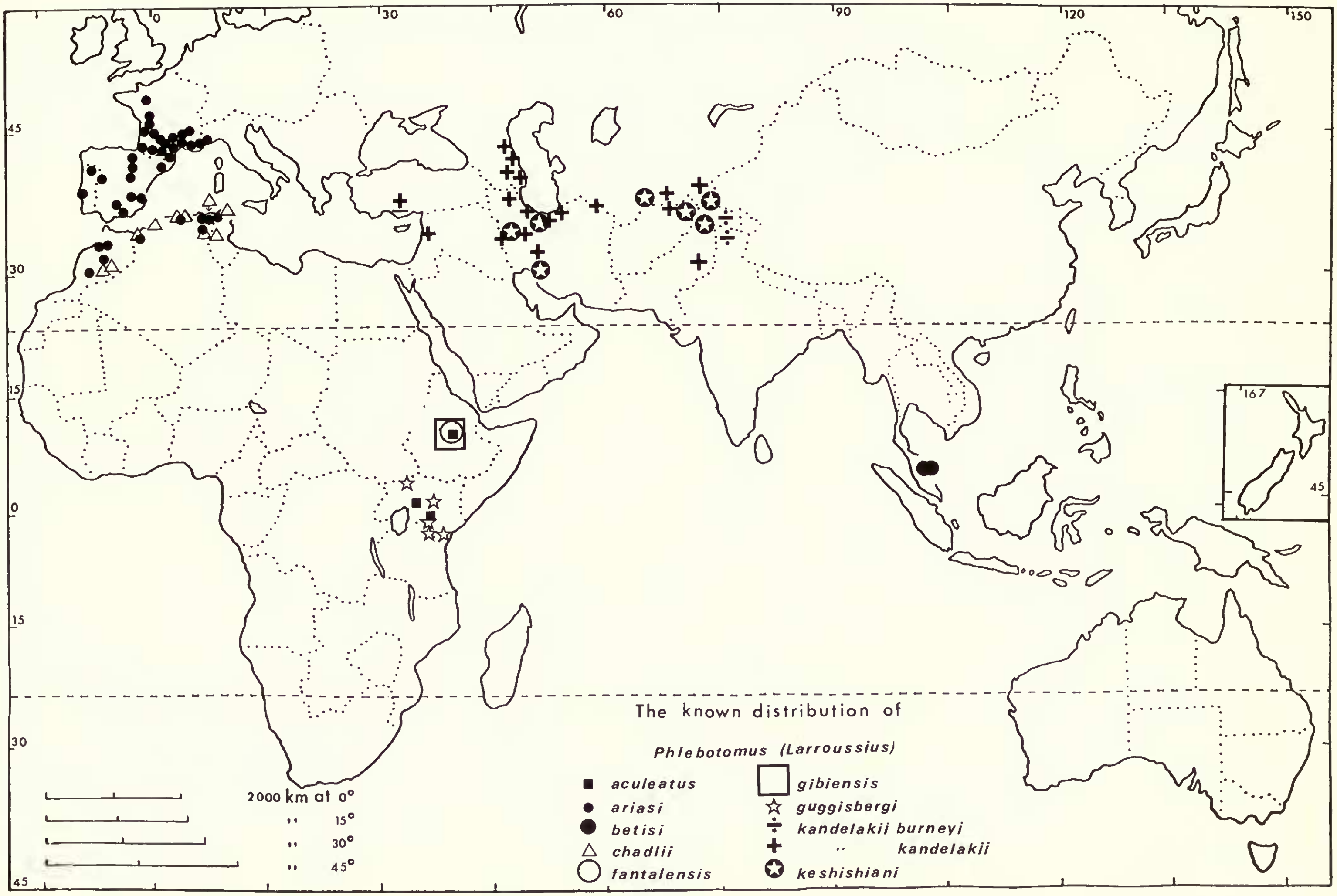
Map 5


The known distribution of
Phlebotomus (Larroussius)
■ *aculeatus*
● *ariasi*
● *betisi*
△ *chadlii*
○ *fantalensis*
□ *gibiensis*
☆ *guggisbergi*
÷ *kandelakii burneyi*
+ " *kandelakii*
✪ *keshishiani*
2000 km at 0°
" 15°
" 30°
" 45°
0
30
60
90
120
150
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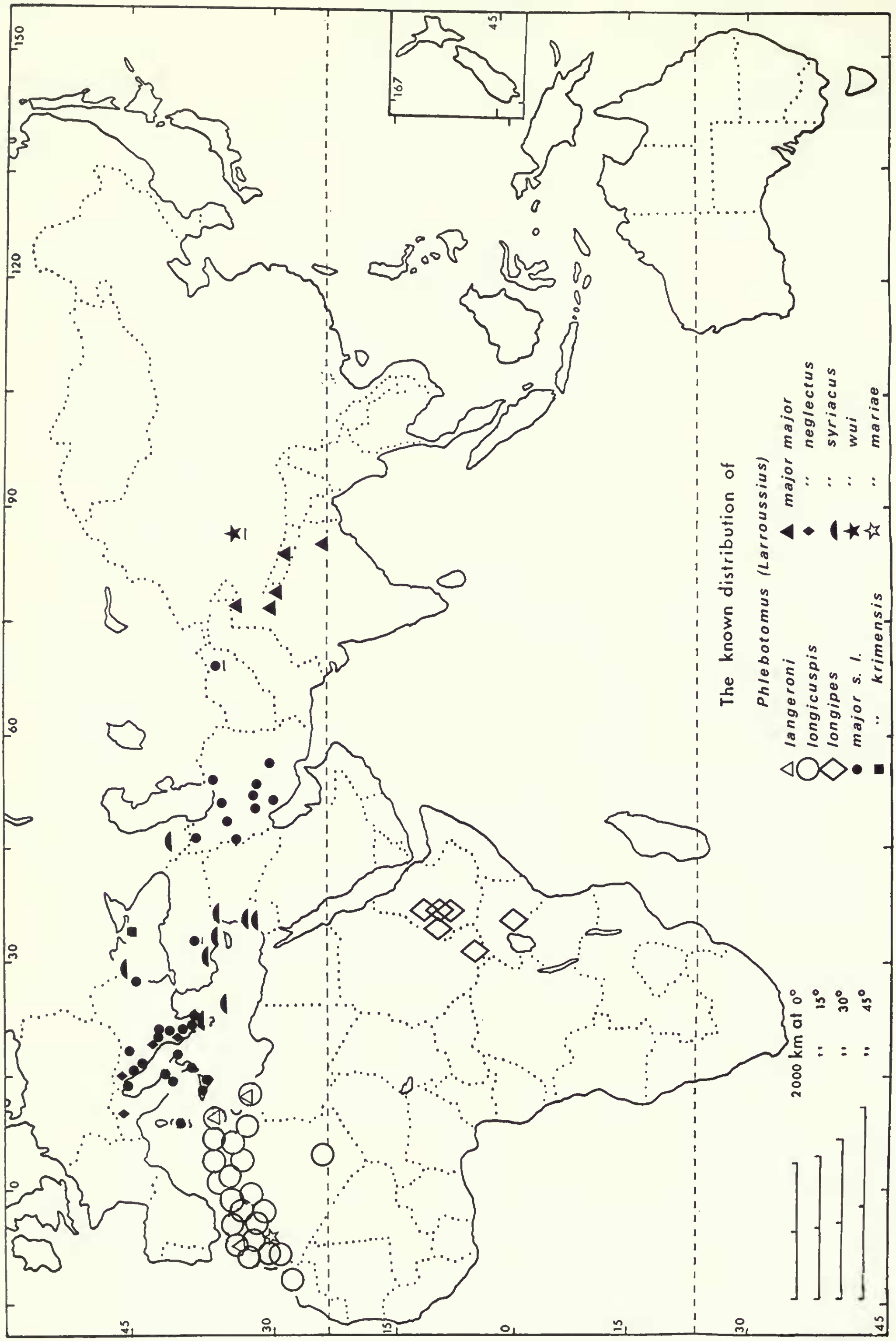
30
15
0
15
30
45
167
45

Map 6


The known distribution of
Phlebotomus (Larroussius)
△ langeroni
○ longicuspis
◇ longipes
● major s. l.
■ " krimensis
▲ major major
◆ " neglectus
◖ " syriacus
★ " wui
☆ " mariae
2000 km at 0°
" " 15°
" " 30°
" " 45°
150
120
90
60
30
0
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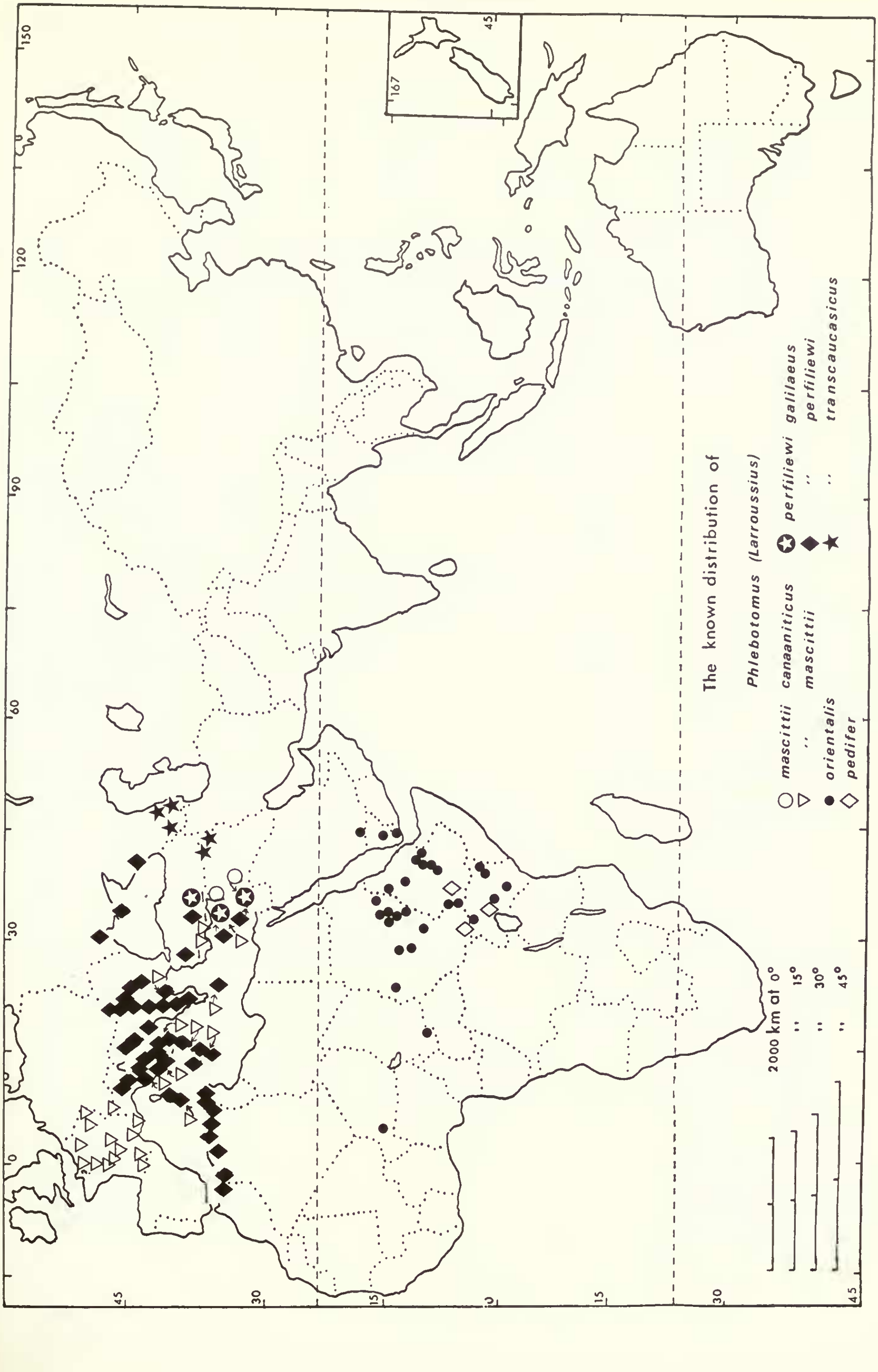
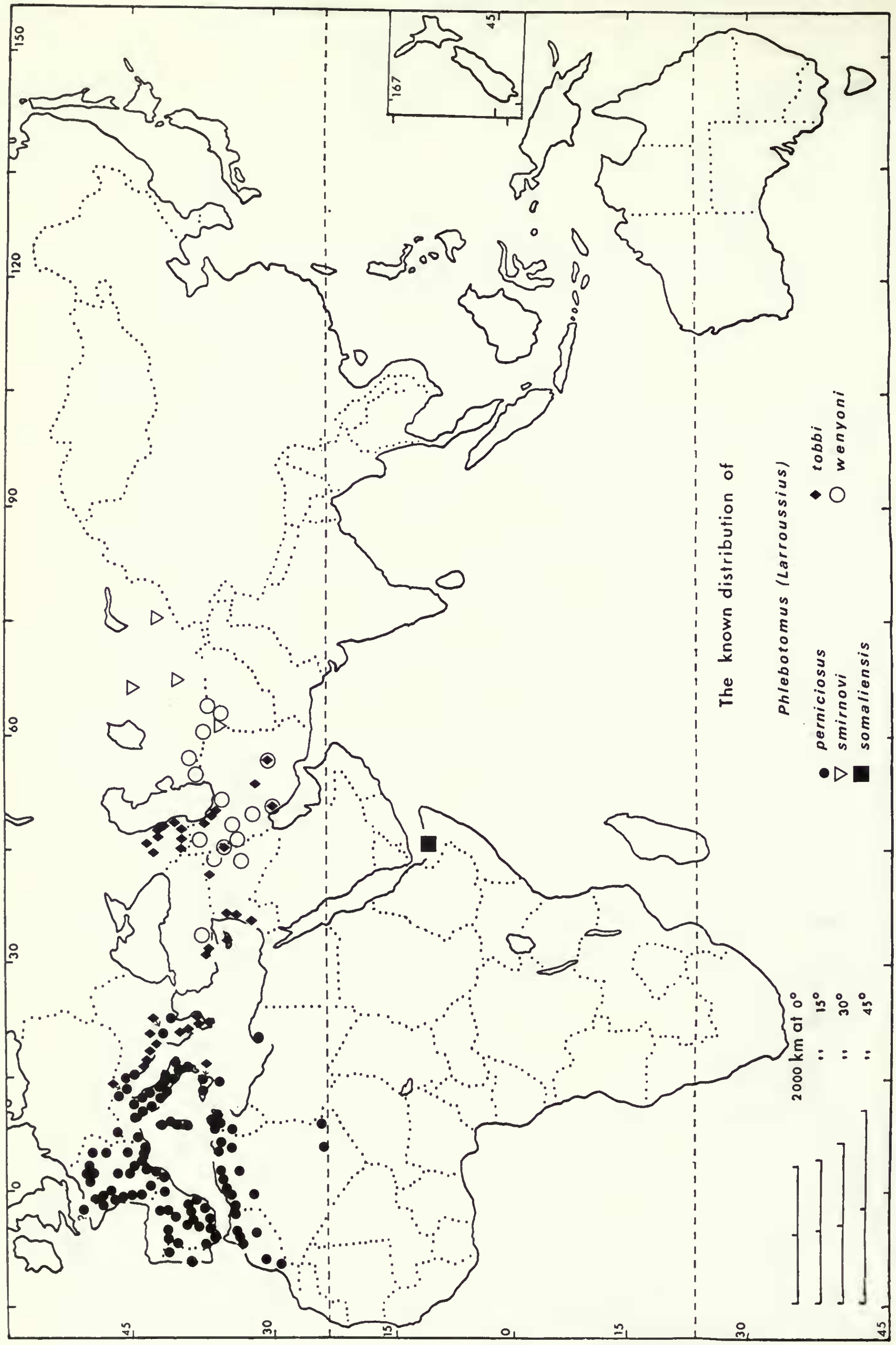
30
15
0
15
30
45
167
45

Map 7



The known distribution of *Phlebotomus (Larroussius)*

Map 8


The known distribution of
Phlebotomus (Larroussius)
● *perniciosus*
▽ *smirnovi*
■ *somaliensis*
◆ *tobbi*
○ *wenyoni*
2000 km at 0°
,, 15°
,, 30°
,, 45°
150
120
90
60
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30
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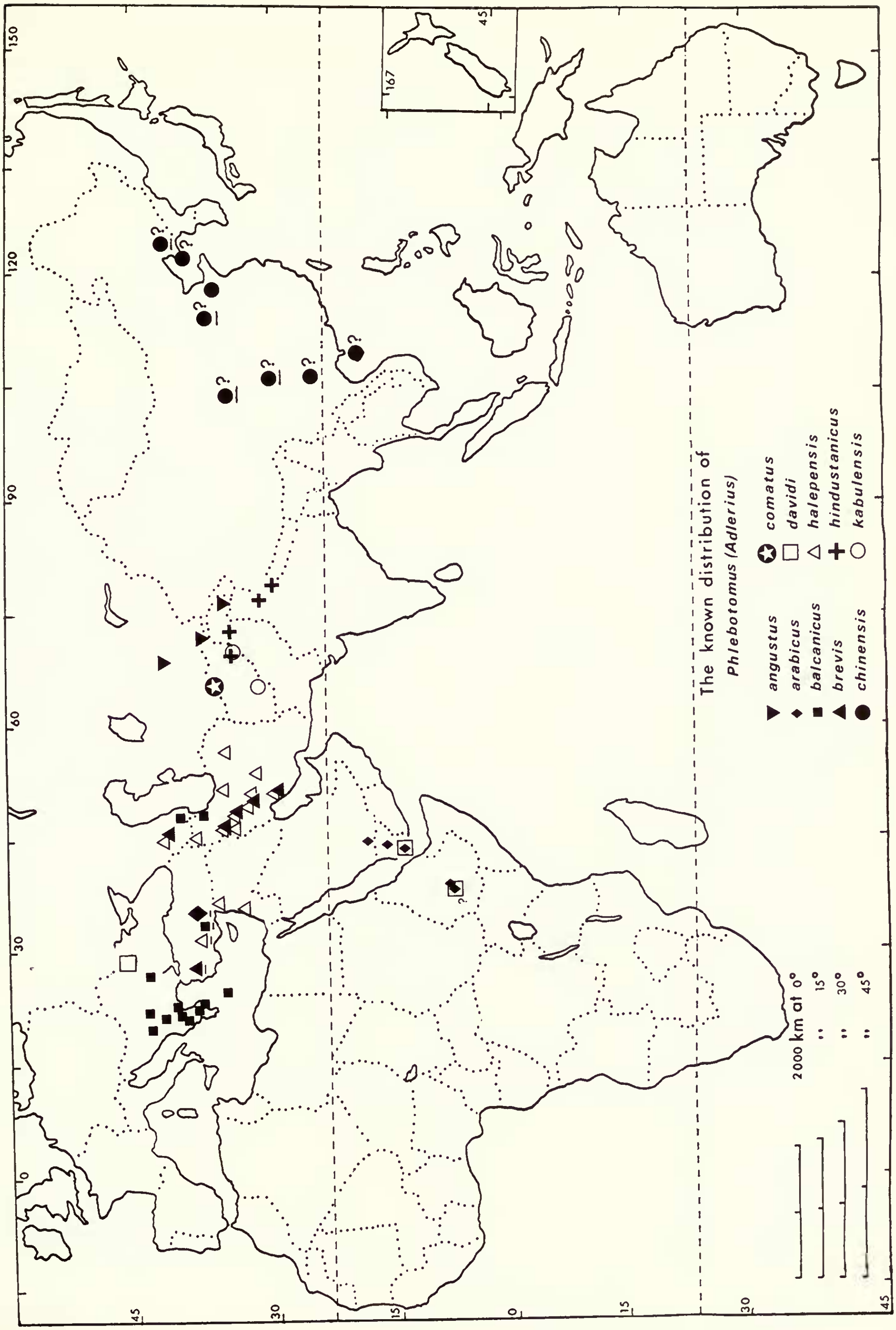
0
15
30
45
167
45

Map 9


The known distribution of
Phlebotomus (Adlerius)
▼ angustus
◆ arabicus
■ balcanicus
▲ brevis
● chinensis
✪ comatus
□ davidi
△ halepensis
✚ hindustanicus
○ kabulensis
2000 km at 0°
„ „ 15°
„ „ 30°
„ „ 45°
?
150
120
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15
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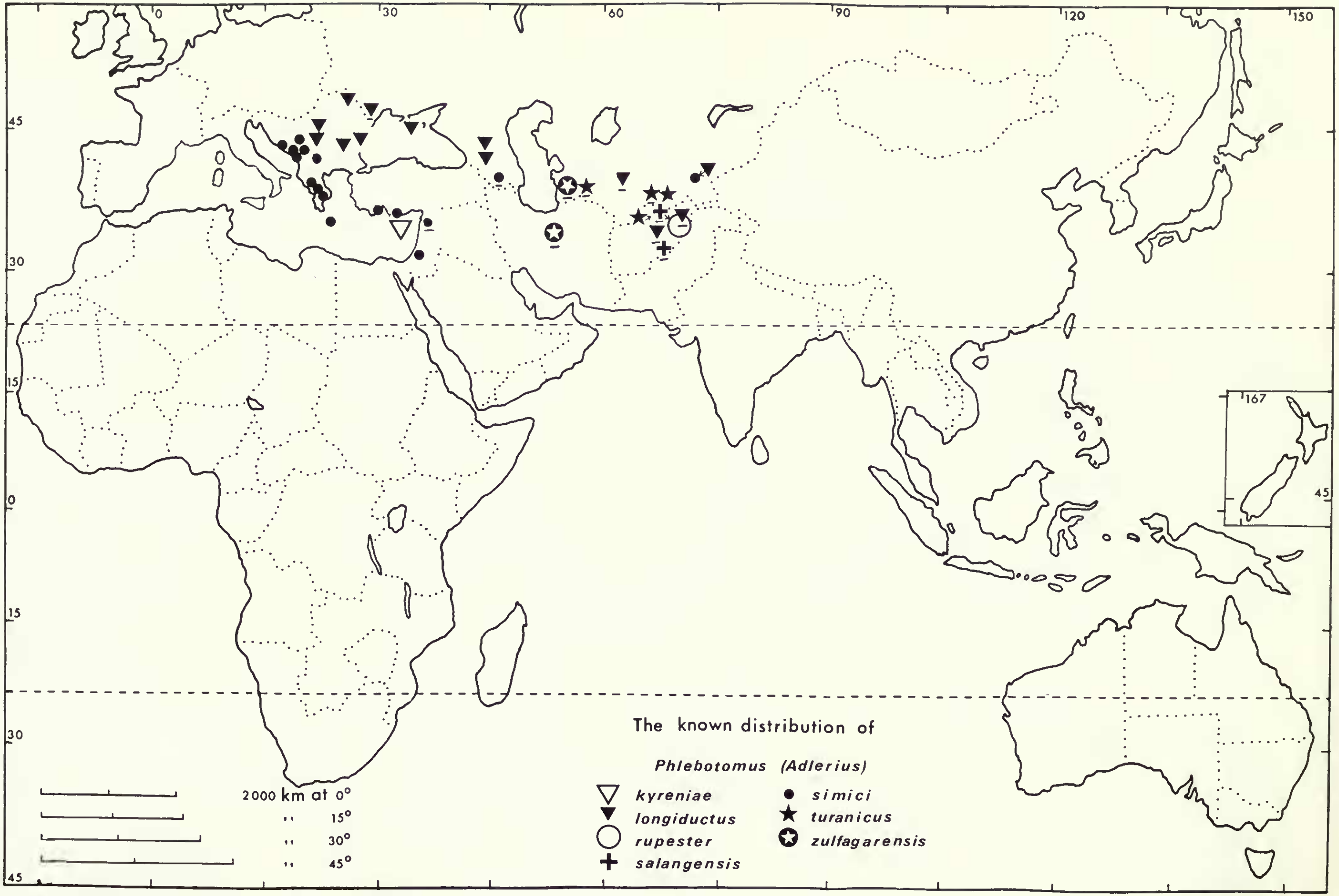
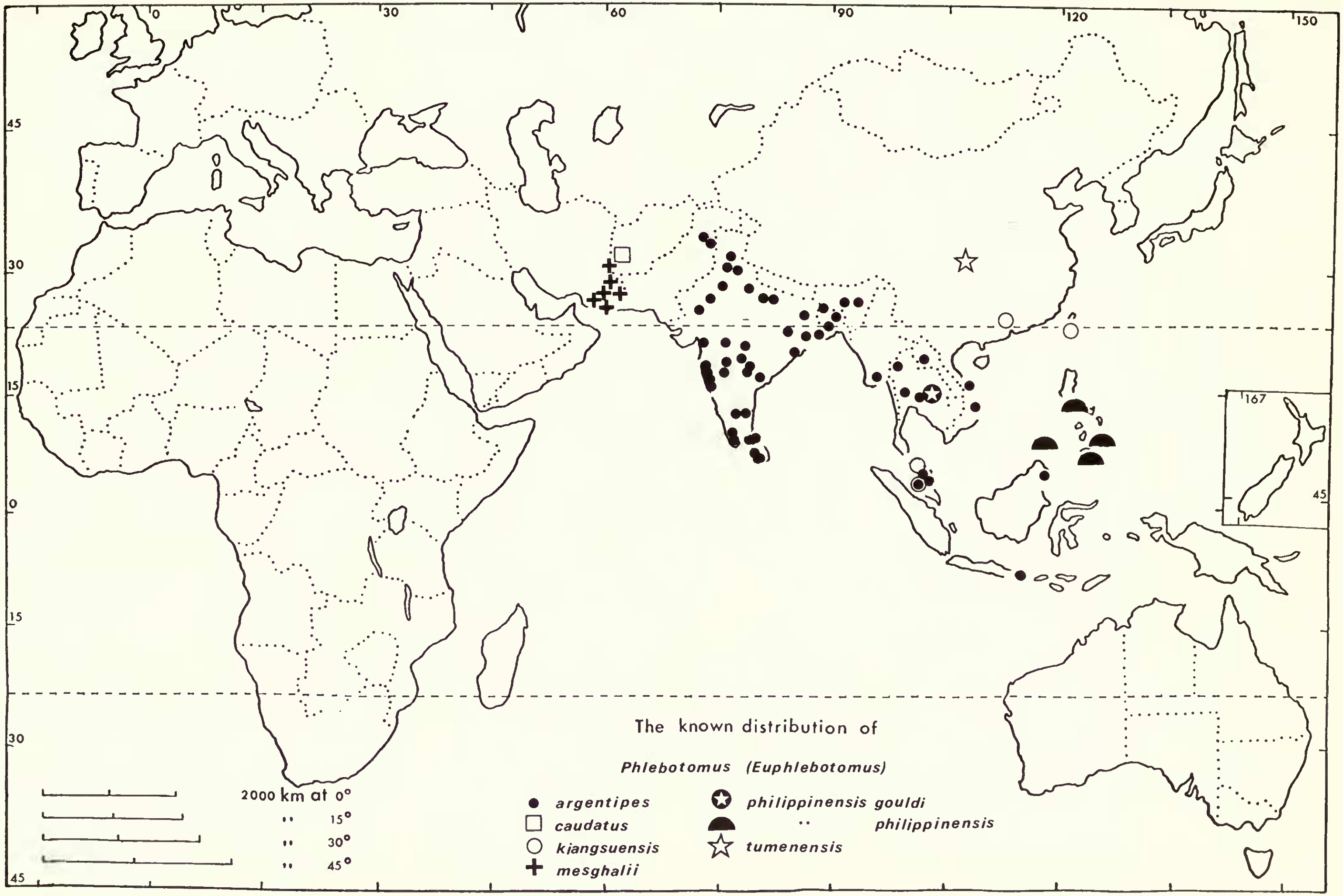
45
167
45

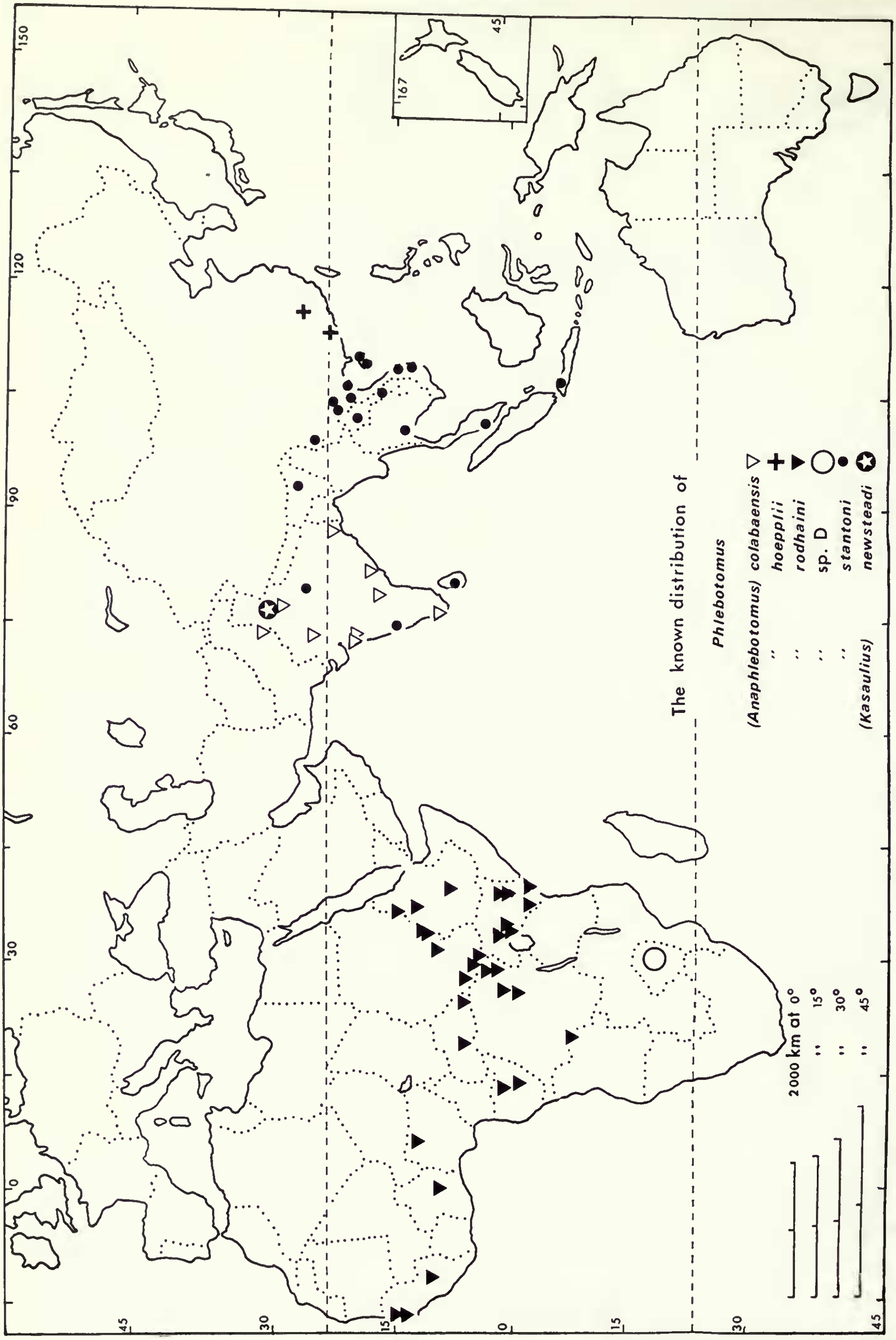
Map 10


0
30
60
90
120
150
45
30
15
0
15
30
45
167
45
The known distribution of
Phlebotomus (Adlerius)
▽ kyreniae
▼ longiductus
○ rupester
+ salangensis
● simici
★ turanicus
✪ zulfagarensis
2000 km at 0°
" 15°
" 30°
" 45°

Map 11


0
30
60
90
120
150
45
30
15
0
15
30
45
167
45
The known distribution of
Phlebotomus (Euphlebotomus)
● *argentipes*
☐ *caudatus*
○ *kiangsuensis*
✚ *mesghalii*
✪ *philippinensis gouldi*
◗ ,, *philippinensis*
☆ *tumenensis*
2000 km at 0°
,, 15°
,, 30°
,, 45°

Map 12


The known distribution of
Phlebotomus
(Anaphlebotomus) colabaensis ▽
" hoepplii ✚
" rodhaini ▶
" sp. D ○
" stantoni ●
(Kasaulius) newsteadi ✪
2000 km at 0°
" 15°
" 30°
" 45°
150
120
90
60
30
0
45
30
15
0
15
30
45
167
45

Map 13

and New World CL at the present day. Mammalian leishmaniae may have developed separately in the Old and New Worlds during this period. Leishmaniae may have been absent from Australia some 120 MYA when, with Antarctica, it separated from the rest of the Old World.

In the Old World reptile leishmaniae presumably continued to exist and, with the appearance of the genus *Phlebotomus*, mammalian leishmaniae may have developed and become widespread, with no special relation to Central Asia (Bray, 1974: 95).

20 MYA to the present day

The increase, postulated above, of the subgenera *Phlebotomus*, *Paraphlebotomus*, *Larroussius* and *Adlerius* in the north of the Old World may have aided the development of mammalian leishmaniae, and thus account for the fact that much of the Old World human leishmaniasis is in northern latitudes, where at least some forms of VL and CL are thought to have arisen. The VL of Kenya and eastern India may have been secondary developments (Garnham, 1977). The vector in India, the only habitual man-biter in the widespread group of subgenera, is the western form of *P. argentipes*, which has adopted peridomestic habits (centred on cattle) in an area of dense human population and consequent destruction of many natural resting sites and wild animals.

Man had become numerous in the Old World about one MYA, long before his arrival in the New World, and in due course a few sandfly species became more or less domestic and therefore more effective vectors of leishmaniae.

The above hypotheses on sandfly and leishmanial evolution, based on circumstantial evidence and conjecture, and postulating an early split between Old and New World sandflies, and a late expansion of *Phlebotomus* in the north of the Old World, offer an explanation of some features of present-day distribution of leishmaniae.

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